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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE, TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORT

FROM

1st JANUARY TO 30th JUNE, 1914.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE, TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORT FROM 1st JANUARY to 30th JUNE, 1914.

By the Director.

I beg to report, in brief, on the work carried out in the Australian Institute of Tropical Medicine, from January to June, 1914.

The staff of the Institute consisted during this term of :—

The Director, Dr. A. Breinl,
Dr. W. J. Young,
Dr. W. Nicoll,
Dr. H. Priestley,
Mr. F. H. Taylor.

The work of the Institute comprised—as in the previous periods—work in connexion with the Hospital Ward and Research work.

It was proposed to hold the first course of Tropical Medicine from the 1st February to the end of April. The course was advertised in the Australian Medical Journals by the middle of December. Unfortunately only two applications were sent in, and it was decided to abandon the course for this year, especially since one of the applicants was prevented by illness from attending the course, and could only have joined a few weeks later.

There was considerable activity in every department of the Institute. Dr. Priestley and myself continued the campaign which was begun in 1913, *i.e.*, to undertake a fairly extensive inquiry into the health and general conditions of school children in Townsville.

As pointed out in the previous report, it was deemed advisable to inquire into the blood conditions of children born and reared in North Queensland, with a view of proving whether the blood of the children was normal as far as the formed elements are concerned, or whether deterioration had taken place effecting an anæmia which could be attributed to climatic conditions only. Previous work on similar lines lacked in one respect, namely, that the persons examined had only been resident in the tropics for a comparatively short period, or were chosen subjects, as for example, American soldiers in the Philippines.

This work took up a great deal of our time, since all the examinations had to be carried out with the greatest possible care and precision in order to be conclusive.

Altogether 580 complete blood counts and hæmoglobin estimations on boys and girls of ages between seven and fifteen were performed. The figures obtained were interesting in as far as we were able to prove conclusively that the average number of red blood corpuscles and their hæmoglobin content corresponded to figures considered normal for Europeans living in a temperate climate.

The average number of red blood corpuscles was 5,076,900, the average hæmoglobin content of the blood was 12·485 gr.

It is very gratifying to obtain normal figures for the blood in children, of whom the majority had been born and bred in Tropical Queensland. The result of this work is embodied in a publication sent to the *Annals of Tropical Medicine*, which will be published shortly.

In addition, the work on the "Arneth Index," begun at the end of 1913, was continued and amplified. Arneth, in 1904, published some striking results, pointing out that the neutrophile leucocytes, which contain a varying number of nuclei, occur in the normal blood in a definite proportion, and an index was calculated, named after the discoverer the "Arneth Index." In his researches on the condition of the neutrophile leucocytes in infectious diseases, Arneth observed the striking fact that the Index, *i.e.*, the number of neutrophile leucocytes containing one and two nuclei, was definitely altered. Researches in this direction were undertaken by many workers and confirmed, especially in patients suffering from tuberculosis. Some time later, Chamberlain, in Manila, inquired into the Arneth Index amongst the American soldiers. and came to the conclusion that, on the whole, there was a slight alteration noticeable, if compared with normal Europeans ; this alteration was, however, in no way sufficiently pronounced to allow the drawing of any definite conclusion.

The blood of school children in Townsville was examined from the same point of view. Altogether an Arneth count was made on 150 school children at the same time as a differential count of the leucocytes. The results were very striking. The first 25 counts, carried out in 1913, indicated a decided alteration in the proportion of the neutrophile leucocytes containing a varying number of nuclei ; the further 125 Arneth and differential counts amplified these observations and made the results obtained at the end of last year conclusive.

The work proved that the Arneth Index of school children born and bred in the tropics shows a decided " shift to the left " when compared with normal children in Europe, resembling the figures obtained by Arneth for patients suffering from an infectious disease.

The meaning of this alteration of the Arneth Index is not understood ; we were however, able to prove that this alteration in the proportions is due to *climatic* influence only. Up to now this is the only existing proof of a climatic alteration of the blood.

Dr. Priestley carried out some experiments in order to decide whether the phagocytic index of the neutrophile leucocytes with a smaller number of indei was smaller than that of the leucocytes with a larger number of leucocytes. His results showed the absence of any marked variation of the phagocytic index corresponding to the number of nuclei or nuclear fragments.

The results of this investigation are being published in a separate paper, sent to the *Annals of Tropical Medicine*, and will appear within the next few months.

I have continued the work on the material collected on the occasion of my last year's journey through the western parts of New Guinea. Making use of the specimens collected during my previous journey through the eastern parts (1913), and adding to and supplementing it by material from similar cases discovered in Western New Guinea, I discovered the parasite causing the disease " Gangosa."

Gangosa, *Rhinopharyngitis mutilans*, is a disease which begins as an œdematous swelling in the skin, in the neighbourhood of the nose, which swelling after a varying period forms a phagedenic sore spreading in the skin of the face, and inwardly eating away the nose and giving rise to extensive mutilation.

The parasite obtained from the serum of early œdematous swellings belongs to the genus *Cryptococcus*, and has been named *Cryptococcus mutilans*, n. sp.

A paper, with a clinical description of typical cases in the various stages of the diseases and a detailed description of the parasite, has been sent to the *Annals of Tropical Medicine.*

The scrapings of about 40 sores of different descriptions have been examined microscopically, and the results will be published shortly in connexion with a detailed statement of the diseases encountered during my stay in New Guinea. A short preliminary report on the observations in the western parts of New Guinea was sent to the Department of External Affairs.

In collaboration with Dr. Young, the results of observations on a number of cases in children, resembling clinically those described first by Drs. Love, Turner, and Lockhart Gibson, in Brisbane, as lead poisoning, are being published in the *Annals of Tropical Medicine.*

From a medical point of view, these cases are of interest, especially in their early stages, since the symptoms are indefinite pains in the calves of the legs and in the epigastrium. In the later stage the drop wrist and drop foot, and in a limited number, the blue line of the gum, so characteristic for lead poisoning, was present.

Dr. Young examined the excreta, fæces, and urine for the presence of lead, and in nearly every case lead was found to be present in smaller or larger quantities—always enough to account for the clinical symptoms.

Dr. Young carried out daily observations of the urine of two cases extending over one week, which showed that the lead was being excreted in varying amounts independent of the medication.

THE WORK IN CONNEXION WITH THE HOSPITAL.

Dr. Priestley and myself had under our care the patients in the tropical wards of the Townsville General Hospital.

During the period of six months, 112 cases in all were treated ; only four deaths took place. The clinical material, on the whole, was varied. It was gratifying to note that the number of cases coming in to the hospital for treatment, especially from the outside districts, is gradually increasing as the Institute becomes better known.

The researches on sprue were continued with a view to elucidate the cause. I was able to isolate a yeast from the typical motions, but was never able to reproduce the disease in animals by means of inoculating pure cultures.

A few experiments were carried out by inoculating diluted sprue motion per rectum into monkeys and cats, without producing anything more than a slight and transient diarrhœa.

Bacteriological examination of one case of climatic bubo only confirmed the previous observations of the sterility of the pus.

Nearly all the bacteriological work in connexion with the hospital patients was carried out by Dr. Priestley, and is reported by him.

During the last six months, the number of books in our library has increased. The Institute has taken over part of my private library, and a number of new books have been added to the collection.

Through the munificence of the C.S.R. Co., who donated £100 towards our library grant, a library was started, which is being augmented by the consultation fees and fees for examination of pathological specimens received by the staff of the Institute. During the six months £25 14s. 6d. was collected in this way.

THE MUSEUM.

Since the arrival of the museum jars, a few months ago, the specimens collected up to now in Townsville, and specimens received from other parts of the tropics, especially from Captain Patton, I.M.S., from Madras, were put on view, so that in the near future the museum will contain typical specimens, not only of complaints of Northern Australia, but also of other parts of the tropics in general.

Number of Cases treated in the Townsville Hospital from 1st January to 30th June, 1914.

Lead poisoning in children	6		
Tropical muscular abscess	2		
Climatic bubo	1		
Snake-bite	1		
Heat exhaustion	1		
	—	11	
Agchylostomiasis	20		
Filariasis	8		
Chyluria	1		
Retroperitoneal abscess (Filariasis)	1		
Tape worm	2		
	—	32	
Typhoid fever	35		
Indefinite fever	15		
Malaria	3		
	—	53	
Enteritis	3		
Sprue	7		
Dysentery	2		
Bronchitis	3		
Tetanus	1		
	—	16	
		—	112

REPORT OF BIO-CHEMICAL LABORATORY.

By W. J. Young.

In March, 1913, daily observations were commenced on the intensity of the violet and ultra-violet rays in the sunlight, by measuring the hourly decomposition of oxalic acid in the presence of a uranium salt. These measurements have been continued until the end of April, 1914, so that the figures obtained over the whole period of thirteen months give a very fair average, as far as these rays are concerned, for comparison of the sunlight in North Queensland, with that in other parts of the globe where the figures are available.

The maximum figure obtained is higher than in any place of which records have yet been published, although these include observations taken at places practically on the equator, such as Kuala Lumpur. The daily average for the whole period is slightly higher than that of Kuala Lumpur. The months with the higher averages were those in the cooler dry season—May to November—when continuous sunny weather prevailed. The maximum intensity, however, was practically the same, both in the hot and in the cool seasons. As the rains occur in the hot season, the lower monthly averages obtained during this period are really due, not to any difference in the intensity of the violet and ultra-violet rays, but to the low figures obtained on those days when the sun is obscured by cloud.

In consideration of these facts, and also as private communications from the Public Health Department in Brisbane state that even higher figures have been obtained there, it does not appear that a high intensity in violet and ultra-violet rays, as measured by this method, is a feature peculiar to tropical sunlight. The observations, therefore, have been discontinued. The results of the thirteen months have been summarized along with the other meteorological observations in a paper written in conjunction with Mr. F. H. Taylor, and this has been sent for publication to the *Journal of Tropical Medicine.*

Last year a study of the nitrogenous metabolism was made in a case of chyluria, and the distribution of the nitrogenous constituents of the urine determined. Further work in this direction was rendered possible by the admission to the hospital in the early part of the year of another case, and an examination has been made of the urine over a period of some days.

Both this and the previous case were true chyluria, the urines always containing fat, which could be readily extracted with ether.

In addition there was a quantity of albuminous matter present, which consisted of lymph proteins, and which clotted to jelly-like masses when the urines were allowed to stand. Examinations of the blood failed to detect any filaria larvæ, a fact which, however, does not prove that the complaint was not of filarial origin.

The results of the analyses showed that the general protein metabolism was not effected by the continued loss of lymph. The relative quantities of nitrogen excreted as urea, uric acid, ammonia, and creatinine were of the same order as those in normal individuals in which similar quantities of protein are being utilized.

In the second case observed, a nitrogen balance was carried out, the intake of nitrogen in the food being determined, as well as the amount excreted in the urine and fæces, and the results showed that nitrogenous equilibrium was being maintained when the diet was constant in amount and of normal protein content.

The quantity of chyle in the urine as measured by the proteins excreted was, on the average, the same whether the diet was free from fat or rich in fat. The usual practice of reducing the fats to a minimum does not appear to be justified by this experiment.

The quantity of protein present in the urine appears to be the best guide to the condition of the patients in chyluria, since these are the substances which form the clots, and which thereby often cause difficulty in passing the urine.

A paper has been written on these experiments, and has been sent for publication to the *Journal of Tropical Medicine.*

Further work has been done with regard to the occurrence of lead in the urine and fæces of children suffering from lead poisoning, and several more cases have been examined.

A study of the general metabolism of white people in the tropics is being carried out with the object of finding out whether the manner in which the body performs its daily functions is in any way different from that which obtains in temperate climates, and whether any fresh means are employed for the regulation of its heat production and nutrition.

As a preliminary, data have been collected with respect to the body temperature.

The effect of a moist heat on the body temperature has been studied by many workers under conditions artificially produced, yet this is not quite the same thing as where the subject is living continually under the conditions, and observers who have previously worked in tropical countries have recorded very contradictory statements with regard to body temperatures. The temperatures of six persons (males) have been taken at fixed times of the day over periods of at least two weeks. The temperatures have been observed both in the mouth and in the rectum, and in some instances in the stream of urine as it issued from the urethra. Most of these temperatures were taken in the hot season, when the wet bulb thermometer between 9 a.m. and 6 p.m. averaged from 74 degrees to 77 degrees Fahrenheit, rising on occasions above 80 degrees.

For comparison temperatures have also been taken during the cooler weather.

Considerable differences have been observed between the temperatures taken at the same time in the mouth and in the rectum, amounting in some cases to over 2 degrees Fahrenheit, whilst the urine temperature was usually found to be in between the two. Even when the body temperatures at a fixed time of day were averaged over the whole period of observation, the mouth temperature was always very much lower than that of the rectum.

Considerable differences were noted between different individuals, which had no connexion with the length of residence in the Tropics. The three highest averages were found in subjects who had been four, two, and one year in the Tropics, whilst another who had lived there for four years had the lowest averages.

The temperatures observed resemble those found by Pembrey for workers in the cotton mills and factories where a high humidity prevailed. On rising in the morning the temperatures, both mouth and rectum, in all cases were below that usually accepted in temperate climates as the normal body temperature ; but immediately after moving about the rectal temperature rose to well above this figure, and remained up during the day. Very slight variations occurred throughout the day in the mouth temperature, whereas rectal temperatures of above 100 degrees Fahrenheit were frequently observed. During complete rest very much lower temperatures were registered.

The temperatures taken during the cooler weather on the same individuals showed, during the middle of the day, very little difference ; but the evening temperatures were decidedly lower. It would appear, therefore, that the body during the activities of the day does not differ much in temperature during the cool and the hot season, but that it cools down more rapidly during the cool season when both the air temperature and the humidity are lower. The temperature during the cooler weather is probably affected by the fact that heavier and warmer clothing is worn during this time of the year.

Experiments have been made on the protein metabolism of the body. The object of these were to ascertain whether any differences could be detected in the manner in which the body utilized its protein in a tropical climate from that found in a temperate climate. It was also thought possible that some information might be obtained with regard to the suitability of food in general use, and the diet most suitable for tropical conditions.

The subject has been attacked by analyses of the composition of the urine, and fairly complete determinations have been made in different individuals of the partition of the different nitrogenous and sulphur constituents, which result from the utilization of protein by the body.

Such an analysis of urine involves a large number of estimations, most of which occupy a good deal of time ; for a complete analysis in a 24-hours' sample of the nitrogenous constituents, the sulphur compounds, the phosphorus, and chlorides, fifteen estimations are necessary, and to obtain a fair average it is necessary to make these determinations daily for a period of several days. It has, therefore, only been possible as yet to obtain complete figures with four different subjects. In each case daily analysis of the total urine passed were made for a week. In other cases, however, the daily excretion of certain products only, the total nitrogen, uric acid, and creatinine, have been determined at different times, the urines being always collected for several days so as to give a fair average.

As preliminary, the Institute staff have been used as subjects. The experiments have thus been conducted upon subjects who have resided in North Queensland for periods varying from one to four years, and who live a moderatively active life.

The subject was allowed to choose his own diet, as it was intended to get a picture of the metabolism under the conditions of every-day life. As it seemed possible that an increased tissue metabolism might occur in tropical climates, special attention was paid to those products which result from this metabolism, and comparisons have been made in a few cases between the daily excretion of these substances during the hot and during the cooler seasons.

Although with so few cases it is premature to draw any sweeping conclusions, the analyses show the following :—

The volume of urine passed, especially in the hot weather, is very much lower than the average for a cool climate.

The specific gravity is higher, showing that the urines are much more concentrated.

The amount of nitrogen present in the daily excretions is smaller than the average quantity given as occurring in temperate zones. As this gives a rough measure of the protein catabolised by the body, it would appear that less protein is used. Considerable differences were found in this respect, both in different individuals and in the same individual at different times. The partition of the nitrogen products is, however, very similar to that occurring in urines of normal individuals living in temperate climates.

When quantities of [these nitrogenous substances are considered as percentages of the total nitrogen, they fall within the limits given in the text books for urines, in which the level of protein catabolised, as indicated by the total nitrogen, is similar to that found in the urines under examination.

There were no signs of an increased tissue or endogenous metabolism, and no difference could be detected between the metabolism of the tissues in the hot and cool seasons. During the cooler weather, the volume of urine was greater and the nitrogen it contained was also somewhat greater.

The amounts of phosphorus and sulphur excreted were similar to those given for temperate climates under the same conditions of diet, but the chlorine was on the whole rather smaller in amount.

In the cases examined, therefore, no striking differences have been observed from those which are given in the text books as averages for temperate climates.

With a view to studying the effect of the black pigment of the skin of coloured races in its protective action against sunlight, the pigment was extracted from the skin of an Australian black. This was purified from all protein matter and a small quantity obtained pure and analysed.

The analysis gave figures for the constituents of the same order as those black pigments occurring in hair, wool, &c.

A solution of the pigment in alkali was examined spectroscopically to ascertain what light rays were absorbed by it. It was found to absorb all the rays in the violet end of the spectrum, the spectrum as far as the green being blotted out, whilst the yellow and red were entirely unaffected.

REPORT FOR THE HALF-YEAR ENDING 30TH JUNE, 1914.

By W. Nicoll.

During the course of the past six months an investigation has been undertaken on the effect of salt and other substances in arresting and preventing the development of the eggs and embryos of the human hook-worm. The object was to ascertain if salt could be employed as a practical means of limiting the spread of infection with the parasite. Eight series of experiments under varying conditions have been completed, and the results obtained, so far, indicate that when a sufficient quantity of salt is properly employed development of the eggs can be completely arrested within 24 hours. On account, however, of the large quantity of salt necessary and the thoroughness required in using it, the method cannot be considered of practical value as an absolutely preventive measure. When smaller quantities of salt are used, the development of the embryos is only retarded, and is not completely arrested until the lapse of a few days. Small quantities might thus be effective if sanitary arrangements insured the removal of the infective material within two days.

Other moisture-absorbing substances, such as potassium acetate and calcium chloride, were tried, but although their effect is greater than common salt, they are not substances which could be readily employed.

Common salt in solutions of varying strength was employed. Even with a strong (6 per cent.) solution, it was found that several eggs still remained alive and capable of hatching out for as long as six days. Using a 2 per cent. solution, larvæ were hatched out nine days later. From this it is evident that a continued application of a strong solution of salt for at least a week is necessary to make certain of destroying all the eggs in the infective material.

Work was continued on worm-nodules in cattle. Experiments were made to ascertain the manner in which the larvæ make their escape from the nodules, and the rate at which they do so.

The investigations were conducted on nodules excised from the carcasses of slaughtered cattle. They were immersed in water and other fluids at different temperatures. Examination of the fluid at intervals showed the presence of larvæ which had escaped from the nodules.

In the course of the experiments, some of the nodules were fixed, cut into serial sections, and a detailed examination made of the sections.

The results of this work indicate that the larvæ make their escape from the nodules fairly readily and in considerable numbers. It would appear that a certain number of larvæ are almost always present in the capsule of the nodule, and that a few of them are continually making their escape into the surrounding tissues.

In the case of some nodules the number of migrating larvæ was very large (several thousands in one instance), but the conditions which determine such an increase have not been ascertained.

Examinations of the sections revealed the fact that the migrating larvæ tend, though not constantly, to be arranged in concentric zones, and are almost invariably found in the denser parts of the capsules. They apparently make their way through the looser tissue with great rapidity. A detailed account of this work is almost ready for publication.

Examination of local animals for parasitic worms has been continued. Over 50 animals have been dealt with, and about half of them have been found infected with worms. Investigation of these parasites has been proceeded with, and many interesting forms have been discovered. A first report on them was published in January of this year, a second report is in the press and will appear shortly, while a third is nearly ready for publication.

Material from human cases infected with parasitic worms has been submitted to me for examination on thirteen occasions. These have proved to be three cases of infection with tape-worms (*Tœniarhynchus saginatus*), six cases of infection with hook-worm alone (*Ankylostoma* and *Necator*), three of the hook-worms along with thread-worms (*Oxyuris*), and one of the hook-worms and whip-worms (*Trichuris*). In some cases both varieties of hook-worms were present together, but in four cases only *Ankylostoma* was found and in one only the American variety (*Necator americanus*). Over 1,000 hook-worms were collected, including 298 *Ankylostoma* and 735 *Necator*. Thread-worms and whip-worms were not numerous.

In most cases infection with these worms was probably acquired in Australia, but in one case of tape-worm it would appear as if the patient had become infected before arrival in this country.

A research on the bacteriology of mosquitoes was commenced. 135 mosquitoes have been examined, comprising the following seven varieties :—

Stegomyia fasciata 51, *Culicelsa vigilax* 57, *Culicelsa annulirostris* 4, *Culex fatigans* 15, *Culex tigripes* 1, *Mucidus alternans* 4, and *Nyssorhynchus annulipes* 3. Most of these were obtained from the living rooms of local houses, but a few were captured in the vicinity of the Institute. In only two of these varieties, namely, *Stegomyia fasciata* and *Culicelsa vigilax*, were any bacteria found, and in these only on few occasions, five times in *Stegomyia* and four in *Culicelsa*. The majority of the mosquitoes examined were females, but several males were included. In the case of the females a considerable number contained blood in their crop.

The bacteria obtained were examined in pure culture. Most of them proved to be of coccoid nature, but on a few occasions bacilli were isolated. As far as could be determined from their cultural characteristics, their bacteria were all such as may occur as contaminations on or n various materials, and none of them could be identified with any of the bacteria which are known to cause disease in man or animals.

A collection of parasitic worms from New South Wales was forwarded by Dr. Burton Cleland, Government Bureau of Microbiology, Sydney. These were examined and a provisional report furnished. A full account will be published later. Several collections have also been received from Dr. Bayon, Government Research Bacteriologist, South Africa. These have been examined and reported upon. Several interesting parasites from rats were included amongst these collections.

REPORT FOR SIX MONTHS ENDING 30TH JUNE, 1914.

By Henry Priestley.

A large amount of time has been spent with Dr. Breinl in the systematic examination of school children in Townsville, and in the working up of the results obtained.

Bacteriological work has been done in connexion with the hospital, and in particular, all patients admitted with symptoms clinically resembling typhoid fever have been carefully examined and cultures made from the blood and fæces, and in some cases, the urine, and Widal examinations made.

It is of interest to note that from only one case has the typhoid bacillus been isolated and that from the blood. The Widal reactions were very irregular and were typical in only a few cases. Bacteria were isolated from several of the patients, which evidently belonged to the Salmonella group but differed in many respects from any known organisms. The casual relationship of these organisms to the disease could not, however, be made out definitely.

From these observations, and from a close examination of the clinical symptoms, one is led to the opinon that there are several varieties of fever in North Queensland, which, while resembling typhoid fever in some respects, differ markedly in other respects.

The subject is still being studied.

A number of sputa and urines have also been examined in connexion with the hospital.

BACTERIAL FLORA OF NORMAL FÆCES.

In continuation of the work commenced last year to determine the effect of life in the tropics on the intestinal flora, an investigation is in progress of the monthly variation of bacteria of the colon group in the fæces of normal persons. The investigation is not yet sufficiently advanced to warrant any conclusions.

WATER EXAMINATION.

The bacteriology of potable waters in the tropics has to be approached from a very different stand-point to that of waters in temperate regions. The warmer air temperatures which are favorable to the development of bacteria, compel one to find different standards for the bacteriological purity of waters in the tropics, and results which would condemn a water for drinking purposes in temperate regions need not necessarily do so in the tropics.

Up to the present little work has been done on water in the tropics, and, as it was observed that considerable changes take place during the year in the character of the water supplied to Townsville, an investigation is in progress upon the monthly variation in the bacterial content of the water. Special attention is being directed to bacteria of the colon group which indicate recent or remote fæcal contaminaton.

The varieties of colon bacilli occurring in the water are being determined, and it is hoped that this, with the examination of the fæces previously detailed, will show whether or not there is any correlation between the bacterial contents of the water and of the fæces.

The water has so far been of very good quality, but interesting results are expected later in the year towards the end of the dry season.

The lactose fermenting organism which occurs most frequently is *B. cloacæ* and the most frequent nonlactose fermenter resembles this closely.

Cultures of *B. cloacæ* are being grown with exposure to sunlight to determine whether the action of the sunlight can convert the lactose fermenting bacterium into the non-lactose fermenter so common in the water. Some indications of a change in this direction have already been obtained.

BACTERIAL MUTATION EXPERIMENTS.

Until recent years, the fixity of bacterial species was one of the canons of bacteriology. Recently, however, it has been shown that bacteria are not so fixed in their characters, and that changes can be produced in various ways.

Work is being done to determine the nature and causation of these changes.

As a tentative hypothesis, it is held probable that the changes which have been induced by growing bacteria in the presence of various chemicals, may be due to the intoxication of part of the bacterial protoplasm, and attempts are being made to induce changes in bacteria by growing them in presence of substances which may have this action.

So far no success has been obtained in this direction.

The problem is also being attacked from another point of view. Substances which are normally present in the human excreta in small quantities are being added to culture media in large quantities and bacteria grown in those mixtures. No changes have so far been detected.

BERIBERI.

A disease analogous to beriberi can be produced in pigeons by feeding exclusively with polished rice, and the current view is that this disease is due to deficiency in some substance which is removed in polishing the rice. This view does not seem to meet all the facts, and other workers, notably Manson, are of opinion that beriberi is an infectious disease, and that the rice merely predisposes to it. In order to examine the infectious theory, pigeons have been fed with all the varieties of rice obtainable locally, but in no case has a beriberi-like disease resulted, showing that either the pigeons are refractory or the rice unsuitable.

The work is to be continued with autoclaved rice, as heating is said to destroy the protective substance.

REPORT OF ENTOMOLOGICAL DEPARTMENT.

By F. H. Taylor.

Most of my time has been taken up in continuing the survey of the blood-sucking insects of Australia, especially of mosquitoes. A thorough knowledge of their distribution is of importance from an epidemiological point of view, since many of them act as disease carriers, and the presence or absence of certain species accounts for the existence or non-existence of these diseases.

Mr. Hill's collection from the Northern Territory has been valuable in this respect, and has proved the wide distribution of *Nyssorhynchus annulipes* (Walker), *Stegomyia fasciata* (Fabr.), and *Culex fatigans* (Wied.) throughout the Territory. Mr. Hill has also discovered *Stegomyia scutellaris* (Walker), in Port Darwin, this being the first record of this species on the mainland of Australia.

The additional records for *S. fasciata*, the yellow fever mosquito, are Port Darwin, Port Charles, Howard Creek, and Koolpinyah.

Culex fatigans, the filaria and dengue fever mosquito, has been found by Mr. Hill at Darwin and Brock's Creek.

Nyssorhynchus annulipes, the probable transmitter of malaria, was found by Mr. Hill at Darwin, Batchelor, and Koolpinyah.

We have also received specimens of a new species of *Stegomyia*, which was taken by him at Melville Island.

We are greatly indebted to Dr. T. L. Bancroft for a very valuable collection of biting insects, chiefly mosquitoes, which show new localities for many previously known species, besides a number of other species new to science. Several specimens of larval forms of mosquitoes were received from him, and will, when worked up, yield interesting information, since little is known at present about the life histories of the Australian mosquitoes.

Dr. Bancroft has found *Stegomyia fasciata* (Fabr.), *Culex fatigans* (Wied.), and *Nyssorhynchus annulipes* (Walker), to be comparatively common at Eidsvold. We have received altogether about 250 specimens of mosquitoes from Dr. Bancroft, besides a small but interesting collection of *Tabanidæ*, and a species of sandfly (*Culicoides* sp.).

Mr. F. M. Littler, of Tasmania, has sent a collection of mosquitoes from several localities in Northern Tasmania containing four new species, detailed descriptions of which have been published in Part IV. of the *Transactions of the Entomological Society of London.*

Mr. Littler has also found *Nyssorhynchus annulipes* (Walker) in Launceston, though it would appear to be comparatively rare, and only one specimen has come to hand.

Mr. W. W. Froggatt, Government Entomologist of New South Wales, sent two interesting collections of mosquitoes from New South Wales and the Solomon Islands.

We are indebted to Dr. R. Hamlyn Harris, Director of the Queensland Museum, for the loan of the Museum collection of mosquitoes. There are specimens of *Stegomyia fasciata* (Fabr.) in the collection from Brisbane and Cunnamulla ; a *Culex fatigans* (Wied.), from Charleville and Cunnamulla ; and *Nyssorhynchus annulipes* (Walker) from the same localities.

We also received a small collection of biting flies from Dr. E. W. Ferguson, of the Bureau of Microbiology, Sydney, for determination. Unfortunately, some of the *Tabanidæ* were too much damaged for determination.

There were two new species of mosquitoes, *Culicada fergusoni* and *Culex biocellatus,* detailed descriptions of which will be published in due time.

Dr. Cumpston has forwarded specimens from time to time, and amongst them it was interesting to note *Nyssorhynchus annulipes* (Walker) and *Culex fatigans* (Wied.) from Melbourne, and a new species of the genus *Culicada* from Toorak—*Culicada victoriensis,* a detailed description of which will be published shortly.

Considerable attention has been paid to the collection of sand-flies in Townsville during the past two years, the number of specimens in the Institute collection being over 400. They, as opportunity offers, will be determined, and their descriptions published.

Only one paper dealing with sand-flies of Australia has been published, and that by the late F. A. A. Skuse, in the Proceedings of the Linnean Society of New South Wales for the year 1889.

In this paper eighteen species were described, all of which were from New South Wales.

Attention is being paid to the collection of flies belonging to the family *Muscidæ* and allied families, owing to the *rôle* they play in the dissemination of typhoid fever, &c.

A considerable number of specimens have already been collected, and their numbers will, it is hoped, be considerably augmented in the near future.

A certain amount of experimental work on the life history of *Stegomyia fasciata* (Fabr.) has been carried out, but a considerable amount of work remains yet to be done before the results can be published.

PAPERS PUBLISHED.

Breinl ..	.. Preliminary Report on the Journey to New Guinea. *Annual Report, Papua,* published 1914, Appendix B.
S. J. Johnston	.. On the Queensland Trematodes. *Quarterly Journal Micro. Soc.,* November, 1913.
H. Priestley	.. Microsporon scorteum n. sp., from a case in man. *Annals of Trop. Med. and Parasit.,* 1914.
H. Priestley	.. Rat Leprosy in North Queensland. *Aust. Med. Gaz.,* 1914.
W. Nicoll ..	.. The Trematode Parasites of North Queensland. 1 and 11 *Parasitology,* 1914.
F. H. Taylor	.. The Culicidæ of Australia. *Transact. Entomol. Soc., London,* 1914.
F. H. Taylor	.. A revision of the Culicidæ in the Macleay Museum, Sydney. *Proc. Linnean Soc., New South Wales,* 1914.
Harvey Johnston	.. Second report on the Cestoda and Acantocephala collected in North Queensland. *Annals of Trop. Med. and Parasitology,* 1914.

PAPERS SENT TO THE PRESS.

A. Breinl	Gangosa in New Guinea, and its Etiology. *Annals of Trop. Med. and Parasitology.*
Breinl and Priestley ..	Observations on the Blood Conditions of Children of European descent residing in Tropical Australia. *Annals of Trop. Med. and Parasitology.*
Breinl and Priestley ..	Changes in the neutrophile Blood Picture of Arneth observed in children living in Tropical Queensland. *Annals of Trop. Med. and Parasitology.*
Breinl and Young ..	The occurrence of Lead Poisoning amongst North Queensland Children. *Annals of Trop. Med. and Parasitology.*
A. Breinl	The Stewart Lectures, 1913.
W. J. Young ..	The Metabolism in the Tropics. *Annals of Trop. Med. and Parasitology.*
W. J. Young ..	A Study of the Nitrogenous Metabolism in Chyluria. *Journ. Trop. Med. and Hygiene.*
Young and Taylor ..	The Coastal Climate of Tropical Queensland. *Journ. Trop. Med. and Hygiene.*
W. J. Young ..	A Note on the Black Pigment in the skin of Australian Blacks. *Bio-chemical Journal.*
H. Priestley ..	Theileria Tachyglossi. *Annals of Trop. Med. and Parasit.*
F. H. Taylor ..	Culicidæ from Papua. *Entomol. Soc., London.*
F. H. Taylor ..	The Culicidæ of Australia, 2. *Linnean Soc., New South Wales.*

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29 JUL

AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,

TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORTS

FROM

1st JULY TO 31st DECEMBER, 1914,

AND FROM

1st JANUARY TO 30th JUNE, 1915.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,
TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORT

FROM

1ST JULY TO 31ST DECEMBER, 1914.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JULY TO 31st DECEMBER, 1914.

I beg to report in brief on the work carried out in the Australian Institute of Tropical Medicine from 1st July to 31st December, 1914.

The staff of the Institute consisted of—

The Director, A. Breinl;
Dr. W. J. Young;
Dr. W. Nicoll;
Dr. H. Priestley;
Mr. F. H. Taylor; and
J. W. Fielding, as Senior Laboratory Assistant.

The work of the Institute comprised research on problems connected with tropical diseases, tropical hygiene and sanitation, and clinical work in connexion with the tropical ward of the Townsville Hospital.

Drs. Young and Nicoll took their annual leave during this period, and attended the Congress of the British Association for the Advancement of Science, taking part in the discussion at several meetings in Sydney and Brisbane. Dr. Nicoll delivered a paper on his researches on Onchocerciasis in cattle, and on animal parasitism in tropical Queensland.

Dr. Priestley spent four weeks away on annual leave.

Mr. F. H. Taylor travelled during the first three months, visiting the coastal towns of North Queensland, with the object of investigating and mapping out the distribution of mosquitoes, especially those known to be carriers of disease, such as *Stegomyia fasciata, Culex fatigans, &c.*

Dr. Priestley and myself left Townsville by the middle of July for Port Douglas, accompanied by Mr. J. W. Fielding, the Senior Laboratory Assistant, in order to study a local fever, "Mossman fever," which occurs endemically throughout the Mossman District.

Previously Dr. Smith, and later Dr. Clarke, published a clinical account on this fever. It was considered advisable to undertake a careful investigation of this interesting disease, especially as to its etiology. Unfortunately the number of cases which entered the Port Douglas Hospital for treatment during our stay was limited—altogether only ten cases were studied.

A great number of smears of the peripheral blood and of the lymph gland juice were stained by various methods, and examined for parasites or bacteria with negative results. The bacteriological cultures made from the blood of several cases remained sterile.

Careful blood examination proved that the number of red blood corpuscles and the amount of hæmoglobin did not undergo any marked change during the course of the disease; the number of white blood corpuscles, on the other hand, increased slightly during the first few days of the fever, but not one case showed a pronounced leucocytosis.

The histopathology of lymph glands extirpated from the neck and the groin showed the typical histological picture of an acute inflammation of the enlarged lymph glands.

Two monkeys were successfully inoculated with blood from patients suffering from Mossman fever. Both animals showed a distinct rise in temperature after an incubation period of nine and ten days respectively (the temperature of the control monkeys remained normal throughout). Guinea pigs did not react in any way to the inoculation of blood of patients.

From an epidemiological point of view, it was ascertained that the majority of cases were farm hands employed in the cane-fields. This and other facts indicated that endemic and glandular fever is, in all probability, in the same way as in dengue, malaria, &c., an insect-transmitted disease. As mosquitoes were, as far as could be ascertained, the only biting insects attacking man and present throughout the year, it seemed most likely that mosquitoes may act as intermediary host.

Only one new species of mosquito was discovered which had not been collected previously anywhere else in Queensland, and was described by F. H. Taylor as *Culex mossmani.* Unfortunately our work was interrupted by the outbreak of the war in Europe, which necessitated our return to Townsville.

The results of the investigation were satisfactory; we were able to prove the susceptibility of monkeys for the fever, a fact which in the future facilitates greatly the search for an intermediary host. The experiences gained allow to exclude bacteria as etiological factor, and indicates that the causative agent may either be a protozoan or may belong to the group of ultra-microscopical micro-organisms.

The results have been published in the *Australian Medical Gazette.*

My own time, after the return from Port Douglas, was employed in working up the material which I brought back from the two previous journeys to New Guinea, and preparing the results for publication. About 200 pieces of tissue were prepared for microscopical examination, and 400 slides of blood and secretion from sores, &c., were studied.

The results of the two journeys are embodied in a publication "On the Occurrence and Prevalence of Disease in British New Guinea," illustrated by 33 photographs, and has been sent to the Annals of Tropical Medicine and Parasitology for publication.

The paper contains a filarial and malarial survey of the coastal districts of British New Guinea, notes on the distribution of leprosy, of juxta-articular nodules, of venereal diseases, yaws gangosa, and of ulcers of various descriptions throughout the districts travelled.

Four diseases which have not been described previously were recorded, a curious and apparently specific fever, two new types of sores which have been named "Contracting Sore" and *Ulcus Interdigitale Destruens,* and a disease characterized by arthritis, osteitis and periostitis.

The results show that the establishment of a branch laboratory of the Institute in New Guinea would yield results of great scientific interest and economic value.

A full account of the last journey from Daru to Port Moresby, profusely illustrated, has been sent to the Department of External Affairs, with a tabulated list of the number of diseased natives found in the more important villages visited.

By invitation of the Shire Council of Innisfail, I delivered, in November, a public lecture on "Tropical Diseases Prevalent in the District and their Prevention." At the time I found that a fever identical with Mossman fever occurs in and around Innisfail.

WORK IN CONNEXION WITH THE TROPICAL WARD OF THE TOWNSVILLE GENERAL HOSPITAL.

From the 1st July to the 31st December, 1914, 71 cases were treated in the hospital as tabulated below:—

Agchylostomiasis	15	Lead poisoning	11
Typhoid	10	Paratyphoid	1
Sprue	7	Dysentery	9
Intestinal colic	2	Tapeworm	2
Filariasis	1	Fevers of uncertain origin	9
Oxyuris infection	1	Observation	3

The number of books in our library did not increase to any extent, except the number of current periodicals. Unfortunately since the outbreak of the war the current numbers of the journals appear very irregularly.

The fees for consultation and microscopic examination received during the six months amounted to £16 14s.

PAPERS PUBLISHED.

A. Breinl, H. Priestley, and J. W. Fielding "On the Occurrence and Pathology of Endemic Glandular Fever, a Specific Fever occurring in the Mossman District of North Queensland."—*Medical Journal of Australia.*

PAPERS IN THE PRESS.

Breinl.—"On the Occurrence and Prevalence of Disease in British New Guinea."

Breinl.—"Daru to Port Moresby. An Account of a Journey on Foot and by Canoe."

REPORT OF WORK DONE DURING THE SECOND HALF OF 1914.

By W. J. Young.

The past six months mainly being the cool season, very little work has been possible upon the problems connected with the metabolism of white people in the tropics.

In August I attended the British Association meetings in Sydney and Brisbane, with the intention of taking part in the proposed discussion in the Physiological Section, at the Brisbane meeting, upon the effects of a hot climate upon the race. Unfortunately, as the result of the war, several alterations were made in the programme, and this discussion did not take place.

During the coming hot season it is proposed to conduct experiments upon the gaseous metabolism in the tropics, and a number of preliminary experiments have been carried out for the adapting and testing of the apparatus necessary for the work.

A few more observations have been made upon the body temperature, as measured in the rectum of white people in the tropics, and a paper has been written on this subject.

The general conclusions seem to be that the limits of the body temperature are not materially different from those found in a cool climate.

The rectal temperature on rising in the morning was usually quite normal, 96 degrees to 98 degrees. With regard to the upper limit of rectal temperature during an ordinary working day, Haldane and Pembrey, from numerous observations on soldiers in England, conclude that this limit must not be placed below 101 degrees Fahr., and the figures obtained in North Queensland agree with this limit.

After rising the rectal temperature rose to 99 degrees to 100 degrees, and was maintained with little variation until the evening, when the temperature gradually went down.

During complete rest much lower temperatures were recorded.

The result of exercise was very marked. After mild exercise, such as leisurely walking for half-an-hour, rectal temperatures as high as 101 degrees or 102 degrees Fahr. were noted, and after exercise had ceased the body cooled down extremely slowly.

Most of the observations hitherto recorded in the tropics have been made in the mouth or the axilla, and only in a few instances in the rectum. It is usually assumed that, although the mouth may not always be reliable in a cold climate, it is a fairly true index in the tropics, where the air is moist and warm. The experiments made in Queensland show that this is not true, the mouth temperature is always lower than that of the rectum even during rest, the difference varying with the individual, and this difference became much more marked after exercise. In some cases differences of 2 degrees to 3 degrees Fahr. were observed after exercise, the mouth showing practically no rise at all, in spite of the fact that at the time the dry and wet bulb thermometers registered 86 degrees and 81 degrees respectively.

Several more cases of lead poisoning in children have been examined chemically, the results bearing out the work already published on the subject.

A research is being carried out on the action of salvarsan and neosalvarsan on the body.

Some time ago Breinl and Nierenstein put forward the theory that when atoxyl was injected into the body, part of it was bound by the serum, this serum-atoxyl then underwent oxidation, an inorganic arsenic being set free, and they attributed the trypanocidal action of the atoxyl to this inorganic arsenic.

Experiments have been made with goats to see if the injection of salvarsan and neosalvarsan is followed by the formation of a similar combination with the serum. The results appear to show that such is the case.

Owing to the disturbance caused by the European crisis, several papers which have been sent for publication have not yet appeared in print.

PAPERS ALREADY PUBLISHED.

"The Coastal Climate of Tropical Queensland—Meteorological Observations taken at Townsville." By F. H. Taylor and W. J. Young. *Journal of Tropical Medicine and Hygiene.* 1st August, 1914.

"A Study of the Nitrogenous Metabolism in Chyluria." By W. J. Young. *Journal of Tropical Medicine and Hygiene.* 15th August, 1914.

"A Note on the Black Pigment in the Skin of an Australian Black." By W. J. Young. *Biochemical Journal,* Vol. VIII. October, 1914.

Papers Still in the Press.

"The Metabolism of White People Resident in the Tropics. (1) The Protein Metabolism." By W. J. Young.

"Lead Poisoning in Children." By A. Breinl and W. J. Young.

"Some Observations on Body Temperature in the Tropics." By W. J. Young.

REPORT FOR THE HALF-YEAR ENDING 31st DECEMBER, 1914.

By William Nicoll.

During the past half-year investigations have been conducted along the following lines:—

Examination of cases of worm infection in man.

During this period sixteen cases have been submitted for examination, thirteen of which proved positive. The majority of these were hook-worm infections, due to Ankylostoma or Necator, or both, frequently accompanied by thread-worms and whip-worms. Only single cases of round worm and tapeworm infections were met with.

The cases may be classified as follows:—

	Total.	Unmixed.	Mixed.
Ankylostoma	5	2	3
Necator	6	1	5
Oxyuris	2	1	1
Trichuris	5	2	3
Ascaris	1	1	0
Tænia saginata	1	1	0

The mixed infections comprised—

Ankylostoma, Necator	1
Ankylostoma, Necator, Trichuris	2
Necator, Oxyuris	1
Necator, Trichuris	1

The number of worms collected from these cases was—

	Total.	Average per case.
Ankylostoma	404	81
Necator	272	45
Oxyuris	2	1
Trichuris	12	2
Ascaris	1	1
Tænia saginata	1	1

Examination of Animals for Parasitic Worms.

Systematic examination of local animals for worm parasites were continued. A total of 63 was obtained, of which 24 (*i.e.*, 38 per cent.) were infected with one or more species of parasites.

Attention has been directed chiefly to edible marine fishes, birds, and domesticated mammals. In comparison with the condition in other regions, from which statistics are available, the fishes show a remarkably low ratio of infection, the percentage being only 21 per cent. The birds have been found to be fairly heavily infected, but the mammals show a relatively low percentage.

From the infected animals over 30 different species of parasites were obtained, including twelve varieties of tapeworm and fourteen of nematode worms.

Work on the identification and description of these parasites and others previously collected has been systematically continued. A second report on this subject was published in *Parasitology*. A third report, dealing with six new genera and eleven new species, is now in the press, while a fourth report is in preparation.

Experiments with the eggs of hook-worms (Ankylostoma and Necator) have been continued. This work has served to confirm and amplify the results set forth in my previous report, namely, that salt and other substances, so far employed, are of little use in the practical and effective sterilization of infected material. Further experiments will be continued as opportunity arises.

A continuous series of observations on the growth and development of larval hook-worms under different conditions has been made. The entire development from the embryonic to the infective stage has been studied in detail, and it has been found that when the eggs are reared under adverse conditions, *e.g.*, in the presence of salt, or putrefying matter, the embryonic development is considerably retarded. Moreover, the larvæ which develop from these eggs grow more slowly than normally, and the mortality amongst them is higher than usual. A fair proportion of them, however, reach the infective stage and live for a considerable time when removed to a favorable medium. The larvæ grow most rapidly on a substratum of well washed and diluted fæces, and may reach their full development within four days. The more concentrated the fæcal material, the less rapidly do the larvæ develop, and unless they can make their escape to a more favorable medium, they eventually succumb. On the other hand the larvæ do not develop well in absolutely clean water ; but when fully mature, they may remain alive in it for a considerable period.

Observations were made on the possible relation between mosquito larvæ and hook-worm larvæ. Some cultures of the latter were inoculated with the eggs of *Stegomyia fasciata*. The larvæ from these eggs were allowed to develop until near pupation. Batches were examined from time to time to discover if the mosquito larvæ had ingested any of the hook-worm larvæ, but the result in every case was negative. No appreciable diminution in the number of hook-worm larvæ could be detected in the cultures.

A considerable number of various insects, flies, and mosquitoes were examined in the hope of discovering the presence of *Filaria* larvæ, and especially *Onchocerca* larvæ. The insects were carefully dissected, and the various internal organs examined, but in no instance was any trace of larval worms found.

Two papers were read at the meeting of the British Association for the Advancement of Science, held in Sydney in August. The first of these dealt with a general account of the parasite worms of tropical Australia. It was remarked that the incidence of worm infection amongst human beings in this region is relatively low, as compared with that in other tropical countries, a fact which may be partly ascribed to the absence of a large indigenous population, and partly to the more advanced state of sanitation.

The only worms which appear to be common in this region are the hook-worms, thread-worms, whip-worms, and filaria, of which only the hook-worms and filaria give rise to serious symptoms. It was pointed out that, with few exceptions, our knowledge of the parasites of domesticated animals, especially cattle and sheep, is extremely scanty. The excessively frequent occurrence of worm nodules in cattle was also noted. The most outstanding features of the parasite fauna of the wild animals, birds, and fishes found in this region were dealt with in a brief survey.

The second paper dealt with some points in the life history of the larvæ of *Onchocerca gibsoni*, the parasite of worm nodules in cattle.

A more complete paper dealing with the same subject has been sent to the press ; but owing to the present condition of affairs, its publication has been postponed.

Further consignments of parasite worms were received from South Africa through Dr. Bayon. These comprised several species of considerable interest from a comparative point of view. A provisional report has been made upon these collections.

REPORT OF WORK DONE DURING THE SECOND HALF OF 1914.

By Henry Priestley.

The first part of the past six months was spent with Dr. Breinl at Port Douglas studying endemic glandular fever (Mossman fever), and in working up the results obtained at the Institute.

A joint communication was made to the *Medical Journal of Australia* embodying the results of this investigation.

The work on the bacteriological examination of the Townsville water supply detailed in the report for the first half-year has been continued. The water has been of fairly good quality bacteriologically, although the total number of bacteria per cubic centimetre of water growing on agar at 37 degrees C. was in most cases much in excess of what is considered satisfactory for a potable water in a temperate climate.

There has been no evidence of recent fæcal contamination, and as has been observed in other tropical countries, the predominant organism of the coli group was *B. cloacæ.*

Attempts to cause mutation in *B. cloacæ* by the effect of sunlight have been continued, but without success.

A detailed examination is being made of the bacterial flora of normal human fæces, in order to determine whether there are any changes which may be correlated with life in a tropical climate. Determinations have been made of the number of varieties of bacteria per gram of fresh fæces growing on various media ærobically and anærobically, special attention being given to organisms of the B. coli group. None of the current methods for counting the total number of organisms in the fæces have proved satisfactory, but percentage counts of the varieties of bacteria in stained slides of fresh fæces have been made.

A sufficient number of examinations have not yet been made to justify the drawing of any definite conclusions, but no striking differences from the conditions found in temperate climates have so far been observed.

An investigation into the mechanism of the agglutination of bacteria by specific sera is in progress, and interesting results have been obtained, which appear to indicate that a very close relationship exists between the agglutination and the precipitating reactions.

Exact quantitative experiments are being done and should give valuable results.

Some clinical pathological work has been done for the hospital and for local practitioners.

	Positive.	Negative.	Total.
Widals for typhoid	6	9	15
Sputum for tubercle bacilli	2	7	9
Swab for diphtheria bacilli	1	0	1
Blood for microfilariæ	0	1	1
Pus for streptothrix	1	0	1

REPORT FOR THE HALF-YEAR ENDING DECEMBER, 1914.

By F. H. Taylor.

Three months of the last half year were spent inquiring into the distribution of mosquitoes in the northern ports of Queensland for the Quarantine Department, with a view to mapping out the prevalence of *Stegomyia fasciata*, Fabr., the intermediary host of the yellow fever parasite.

The expedition was made possible by a special grant of £100 from the Quarantine Department.

It was found that *Stegomyia fasciata* was prevalent in all the ports of North Queensland, particularly Normanton and Thursday Island.

A new species of culex was also found in Normanton, which is very distinct from those previously known from Australia. In addition to this new species, the distribution of several known forms has been considerably extended. One species (*Skusea uniformis*), previously known from India, was found in Cairns.

The collection received from Mr. G. F. Hill, Government Entomologist, Port Darwin, last June, has been examined, and the species identified. This collection has proved one of the most interesting received by the Institute for purposes of identification since Mr. Hill has found species, which have only previously been known in the southern portion of Australia. This collection also contained three species, which have not been previously recorded from the mainland. One species (*Hodgesia triangulatus*) was originally described from Papua, one (*Reedomyia pampangensis*) from the Philippine Islands, the other specimen (*Chrysoconops aurites*) has been recorded first from West Africa, and later from the Philippines and China. These additions to the known mosquito fauna of Australia help to throw additional information concerning the relationship of our mosquitoes with those of the East.

The mosquitoes collected by the expedition to Port Douglas have been worked out. Amongst them were found the male of *Myzorhynchus barbirostris*, var. *bancrofti*, which has not previously been found, and a species of *Culex*, new to science, with spotted wings, which in some respects mimics the Anopheline mosquitoes. Very few of the genus *Culex*, with spotted wings, have been found in any part of the world, and only two have been found in Australia.

The results of the three collections have been embodied in a paper, which wil soon be sent to the press for publication.

In addition to the above work, experiments are being undertaken with a view to ascertaining the life cycle of *Stegomyia fasciata*, as it is of great importance to know the exact time it takes, at different periods of the year, for this mosquito to attain its adult state from the egg stage, so that should yellow fever ever reach a Queensland port, the duration of the life cycle of the mosquito in Queensland will be known, and render its destruction easier.

One paper has been published during the past six months : " Contribution to a Knowledge of Australian *Culicidæ*, No. 1 " (Proc. Linn. Soc., New South Wales, November, 1914), containing descriptions of seven new species and notes on previously known forms.

List of Species Sent for Determination by Mr. G. F. Hill, Port Darwin.

Myzorhynchus barbirostris, var. *bancrofti* (Giles).
Nyssorhynchus annulipes (Walker).
Stegomyia fasciata (Fabr.).
Stegomyia hilli (Taylor).
Stegomyia scutellaris (Walker).
Pseudoskusea basalis (Taylor).
Scutomyia notoscripta (Skuse), var.
Macleaya tremula (Theobald).
Reedomyia pampangensis (Ludlow).
Culicelsa vigilax (Skuse).
Culicelsa paludis (Taylor).
Culex fatigans (Wied).
Culex occidentalis (Skuse), var.
Culex tigripes (G. et C.)
Culex sitiens (Wied).
Tæniorhynchus uniformis (Theobald).
Chrysoconops acer (Walker).
Chrysoconops aurites (Theobald).
Skusea funerea (Theobald).
Hodgesia triangulatus (Taylor).

List of Species Collected at Port Douglas.

Myzorhynchus barbirostris, var. *bancrofti*, (Giles).
Nyssorhynchus annulipes (Walker).
Stegomyia fasciata (Fabr.).
Culicelsa vigilax (Skuse).
Culex fatigans (Wied).
Culex n. sp.

List of Species Collected by Myself in the Northern Ports.

Myzorhynchus barbirostris, var. *bancrofti* (Giles).
Nyssorhynchus annulipes (Walker).
Mucidus alternana (Westw.).
Stegomyia fasciata (Fabr.).
Stegomyia punctolateralis (Theobald).
Pseudoskusea basalis (Taylor).
Scutomyia notoscripta (Skuse).
Macleaya tremula (Theobald).
Culicelsa vigilax (Skuse).
Culex fatigans (Wied).
Culex occidentalis (Skuse).
Culex n. sp.
Tæniorhynchus uniformis (Theobald).
Chrysoconops acer (Walker).
Finlaya poicilia (Theobald).
Skusea funerea (Theobald).
Skusea uniformis (Theobald).
Hodgesia triangulatus (Taylor).

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,
TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORT
FROM
1ST JANUARY TO 30TH JUNE, 1915.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT—1st JANUARY TO 30th JUNE, 1915.

I beg to report on the work accomplished during the last six months in the Australian Institute of Tropical Medicine.

As in the previous period, the staff consisted of—

The Director, A. Breinl;
Dr. W. J. Young;
Dr. W. Nicoll;
Dr. H. Priestley;
Mr. F. H. Taylor; and
J. W. Fielding, Senior Laboratory Assistant.

A considerable amount of work has been accomplished in the various departments of the Institute. Mr. Taylor was absent on his yearly leave from 1st May to 11th June.

Dr. Priestley accompanied Dr. Rodger, the Ophthalmic Inspector of the Department of Public Instruction, on one of his journeys through the western districts of Queensland, studying the eye conditions prevalent amongst the school children. Many of these cases have been diagnosed in the past as trachoma, although they differed clinically in several respects from the trachoma that occurs in Europe. The result of the investigation showed that many of the cases were true trachoma, as "trachoma bodies" were found in their conjunctiva.

Mr. F. H. Taylor spent approximately ten weeks on an expedition to the coastal towns situated between Townsville and Brisbane investigating the occurrence, prevalence, and breeding grounds of mosquitoes, especially *Stegomyia fasciata*, the transmitter of yellow fever.

The occurrence of the war prevented the holding of a course in tropical medicine since a great number of medical practitioners and young graduates have joined the colours, leaving Australia for the seat of war.

During this period Dr. Giblin, resident medical officer at Samarai, spent a few weeks in the laboratory, availing himself of the opportunity to become conversant with laboratory methods, and with the microscopical diagnosis and the treatment of tropical diseases occurring in New Guinea.

Dr. Hoggarth, at present resident medical officer at the Townsville Hospital, is working during his spare hours in the Institute, studying laboratory methods.

I was able to secure the collaboration of Dr. Marshall, resident medical officer at the hospital at Guadalcanar, British Solomon Islands. A certain amount of interesting histological material was received from him for examination, which will be useful in the future for teaching purposes. It is hoped that in time several more of the workers in the Pacific will avail themselves of the co-operation of the Institute.

During the first half-year I was engaged in the investigation of problems in connexion with beri-beri.

During the last few years several authors proved conclusively that a diet consisting of highly-polished rice exclusively may give rise to beri-beri. My own previous experiences as regards this disease in other parts of the tropics, as well as those of other observers, have shown that beri-beri is a place-born disease, in other words, that the inhabitants of certain buildings, as gaols or hospitals, where beri-beri cases had occurred previously, may develop the disease, even when living on an ordinary diet.

The occurrence of a beri-beri-like disease, characterized by a pronounced paralysis of the legs and other symptoms amongst pigeons, which develops when fed exclusively on highly-polished rice, made this experimental work possible.

McGarrison, in one of his papers, described the occurrence of a bacillus of the suipestifer group in the organs and blood of infected pigeons, a pure culture of which was supposed to cause a similar disease when inoculated into normal pigeons.

For the present investigation a number of pigeons were fed daily on polished rice and developed the well-known symptoms. The incubation period and the duration of the disease was carefully noted, and bacteriological cultures of the heart blood of pigeons, which had died of the disease, were made.

A shortening of the incubation period in the "infected cages," and the occurrence of a similar disease amongst pigeons kept for some time in infected cages on normal diet, would have proved beyond doubt that the disease in question is not solely due to a deficiency of the substances in the diet, called vitamines, but that infection plays a certain *rôle*.

The irregularity and prolongation of the incubation period in our first experiments, when compared with the results of observers in Europe, was an additional argument in favour of the hypothesis that a diet consisting of polished rice may only prepare the organism of the pigeon for a bacterial invasion.

Experiments undertaken on a somewhat larger scale proved, however, that the prolonged incubation period on our first experiments was only accidental, and that the incubation period in infected cages, where a number of generations of pigeons had died of the disease, did not become shortened. The bacteriological examination of the heart blood of a number of pigeons killed when the disease had become fully developed proved entirely negative. The results of this work will be published shortly.

I undertook investigations into the morphology of "yeast," which had been isolated from the evacuations of patients suffering from sprue. This work proved very difficult, and has not yielded any definite results up to the present.

An epidemic of dengue fever in Townsville gave the opportunity to attempt the transmission of dengue fever to monkeys by means of inoculation of blood from patients taken in the different stages of the disease.

A number of experiments (six), however, showed that monkeys did not react in any way to the inoculation of large quantities of blood drawn from the veins of fever patients, and further proved that dengue fever differs from endemic glandular fever occurring in some of the coastal parts of North Queensland, which can be transmitted to monkeys.

In collaboration with Dr. Priestley our researches on the etiology of sprue were continued. A number of strains of yeast were inoculated from the motions, as well as from the tongue, &c., of cases suffering from "sprue." Previously, sprue motions containing yeasts were fed to different experimental animals as monkeys, cats, and dogs without any untoward result. In a few experiments an inflammation of the mucous membrane of the intestinal canal was produced artificially, and sprue motions injected per rectum. The results were still disappointing.

The similarity of the symptoms of sprue to that resulting from lesions of the pancreas, suggested the attempt to infect animals after the pancreatic duct had been tied off. In a few dogs this duct was ligatured, and strains of yeast as well as sprue motions obtained from sprue patients were fed to dogs. As the results were still negative, the pancreas of dogs was totally extirpated. These latter experiments, however, are still in progress and have not been concluded.

In collaboration with Dr. Young, experiments were undertaken on serum ferments and their antiferments. These experiments have, up to the present, not yielded definite results.

In collaboration with Dr. Priestley Arneth counts were performed on blood films of adult New Guinea natives and native children. Our previous observation on the Arneth index in North Queensland school children had showed that the neutrophile blood picture of children, who had been born in North Queensland, and had lived there for most of their life, resembled that of Filipinos, as recorded by Chamberlain and Vedder. As opportunity offered, it was considered of interest to study for comparison the neutrophile blood picture of New Guinea natives, considering adults and children separately. The neutrophile blood picture, as far as one could gauge of *healthy* adult natives, corresponded closely to that of North Queensland school children. The Arneth index being 74.0, as compared with 74.5 for Queensland children—40 is considered normal for Europeans living in a temperate climate. The Arneth count of native children gave a somewhat higher index, namely, 83.

The observations of the similarity of the Arneth index in North Queensland children to that of adult New Guinea natives is a further proof for our assumption that the change of the neutrophile blood picture, and consequently of the Arneth index, is a result of climatic influences. The still greater increase of the Arneth index in native children, on the other hand, is probably due to the incidence of disease, especially yaws and malaria, both of which are endemic amongst children in most of the districts of New Guinea visited during my journey.

During the period 112 patients were admitted to the tropical ward of the Townsville Hospital. With the exception of dengue fever, the number of patients admitted suffering from tropical diseases has been somewhat disappointing, probably owing to the continued dry weather.

1.	Febricula	11
2.	Typhoid	8
3.	Malaria	5
4.	Dengue	55
5.	Heat exhaustion	3
6.	Agchylostomiasis	12
7.	Filariasis	3
8.	Dysentery	5
9.	Sprue	5
10.	Tropical intra-muscular abscess	3
11.	Lead poisoning	1
12.	Climatic bubo	1
	Total	112

Full use has been made of the clinical material. Dr. Priestley and myself modified the treatment of sprue cases in vogue at present, and the results were highly satisfactory.

LIBRARY.

The number of volumes in our library has not been greatly increased during the last six months.

Dr. W. B. Nisbet, of Townsville, presented our library with 84 volumes of the *British Medical Journal*, *Australian Medical Gazette*, and the *Practitioner*, which are a valuable gift, and have been incorporated in the library.

The fees for consultation and microscopical examination during the six months amounted to £21 7s. 6d.

PAPERS SENT TO THE PRESS FOR PUBLICATION.

Breinl and Priestley—" Note on Boomerang Leg."

Breinl and Priestley.—" Differential Counts and the Neutrophile Blood Picture of Natives—Adults and Children—of New Guinea."

REPORT FOR THE HALF-YEAR ENDING JUNE, 1915.

By W. J. Young.

During the past six months investigations have been continued into the constituents of the urine of white people living in the tropics. It is commonly held that the incidence of kidney troubles is greater in tropical climates than under temperate conditions, and this has been attributed to the greater concentration of the urine passed in the tropics caused by the greater loss of water by sweating.

Special attention has been given to the concentration of salts and to the osmotic pressure, as measured by the depression of the freezing point. The whole urine passed during the 24 hours has been collected and examined in the case of 24 subjects and a good deal of data collected, which may throw light on the subject.

An examination of the acidity of the urine, as measured by the concentration of hydrogen ions, has also been commenced.

Work is being continued on the respiration exchanges. An investigation is in progress into the mechanism of the action of organic arsenic compounds in the treatment of certain protozoan diseases. Experiments have been made, which show that salvarsan and neosalvarsan form combinations with the proteins of the blood serum, and the results have been embodied in a paper, which is now ready for publication.

Further experiments are in progress upon the *rôle* played by the blood of the host harboring the parasites in the conversion of these arsenic compounds, which are themselves non-toxic to the parasites, into toxic substances, and to ascertain the nature of the toxic substance produced.

A good deal of doubt and confusion exists as to whether the injection of enzymes into the animal body is followed by the production of true antibodies to the enzyme injected. In conjunction with Dr. Breinl experiments are being carried out to try and throw some light upon this question.

A study is also being made on the nature of the antibody to the enzyme trypsin which occurs in the blood serum of normal animals.

In addition a few examinations have been made of pathological material submitted to the Institute for diagnosis, and a periodical chemical analysis of the Townsville water supply has been conducted in conjunction with Dr. Priestley, who has done the bacteriological work.

The following papers have appeared :—

"The Occurrence of Lead Poisoning Amongst North Queensland Children." By A. Breinl and W. J. Young. *Annals of Tropical Medicine*, Vol. VIII., page 575.

"The Metabolism of White Races Living in the Tropics. I. The Protein Metabolism." *Annals of Tropical Medicine*, Vol. IX., page 91.

In the Press.

"The Body Temperature of White People Living in the Tropics."

"The Fixation of Arsenic by the Blood Serum after the Injection of Salvarsan."

REPORT FOR THE HALF-YEAR ENDING 30th JUNE, 1915.

By W. Nicoll.

Since the date of last Report the following investigations have been in progress :—

Experimental work on worm nodule disease in cattle has been continued. Part of this work dealing with the migration of the larval worms has been completed, and the results have been published. In addition, observations have been made on the occurrence of worm nodules in calves, and on the mode of entry of the parasite into the animal. A number of calves have been thoroughly examined. From each of these, in the first place, a quantity of blood was taken and examined for larva worms. In each case the results were negative. The calves were then killed, and a complete examination made of all the tissues and organs likely to harbor larval or mature worms. A large number of smears were examined and cultures were made from various tissues, but no trace of worms could be found.

Experimental work has also been continued on the larval development of the hook-worm (*Anchylostoma* and *Necator*). The experiments have been mainly confirmatory of the results recorded in the previous Report, but in addition several series of experiments on the effect of direct sunlight have been conducted. This work has, for the time, been completed, and the results are in process of publication.

An interesting worm parasite of Australian poisonous snakes has been investigated, and a description of it will be published shortly.

Work on the trematode parasites of reptiles and frogs has also been progressing, and a full report on those is being prepared.

The number of human cases of worm infection have been smaller than usual. The majority of these have been cases of hook-worm infection. Several domesticated animals have been examined, and from them a considerable number of parasites have been obtained. Native animals, birds, &c., have been systematically examined, and have yielded a fair number of parasites.

Some experiments have been made on dogs with human and canine hook-worm, the object being to investigate the possible occurrence of immunity to hook-worm infection.

Experiments have also been made with a view to elucidating the life history of the lung-worm of the blue-tongued lizard.

A beginning has been made with experimental work on the development and life history of the eye-worm of chickens. These worms are common in this district, and are believed to be the cause of a serious eye disease, a belief, however, which awaits confirmation.

The filarial worms found in North Queensland animals have also received some attention.

The following paper has been published:—

"On the Migration of the Larvæ of *Onchocerca gibsoni* through the Capsule of the Worm Nodule."

The following paper is in the press:—

"The Trematode Parasite of North Queensland," III., Parasites of Fishes.

REPORT FOR THE HALF-YEAR ENDING JUNE, 1915 (JANUARY TO JUNE, 1915).

By Henry Priestley.

A certain amount of routine work in the nature of examinations of sputa, pus, urine, and blood and Widal reactions has been done both for the hospital and for private practitioners.

The work commenced in 1914 on the fæcal flora of white people living in North Queensland has been continued, as also has the investigation into the bacteriology of the Townsville water supply.

The anomalous results obtained with the Widal reaction in cases of typhoid in Townsville have directed attention to the agglutination reaction, and a considerable amount of work has been done with the idea of elucidating the mechanism of the reaction.

Important observations have been made which place the subject on a new basis.

An investigation is in progress as to the nature of yeasts isolated from cases of sprue. It is hoped to obtain some data as to the etiology of sprue.

With Dr. Rodger, the Ophthalmic Inspector of Schools for Queensland, I spent a fortnight in visiting the towns of Winton, Hughenden, Cloncurry, and Richmond, in order to investigate the eye diseases occurring amongst children in the west—particularly trachoma.

The children in the schools in these towns were examined, and material obtained which was worked up at the Institute. A paper has been published, in conjunction with Dr. Rodger, in the *Medical Journal of Australia*, embodying the results obtained.

The importance of eye diseases to the community cannot be over-estimated, and the elucidation of the true nature of the eye complaints met with in Western Queensland is essential, in view of the measures to be taken for prevention and treatment.

The most important of the diseases is what has been called "trachoma," or blight. It was obvious that the disease which passed under this name in Queensland differed in some respects from the trachoma occurring in Europe, and it was necessary to determine whether the disease occurring in Western Queensland was a modified form of true trachoma, or merely a disease superficially resembling trachoma.

Cultures were taken from the eyes of children suffering from trachoma and other eye affections, but the results obtained simply showed that one was not dealing with ordinary conjunctivitis.

Much more important were the scrapings from the conjunctiva of affected eyes. In the conjunctival cells of trachoma cases bodies have been described, which are called "trachoma bodies." These have been considered by many investigators as pathognomic of trachoma.

The cases examined by us were divided into those which we considered to be trachoma clinically and the non-trachomatous cases. In none of the non-trachomatous cases did we find "trachoma bodies," while in many of the trachoma cases we did find these bodies.

A consideration of the climatic feature of the disease, as it exists in Western Queensland, together with the finding of "trachoma bodies," leads us to the conclusion that true trachoma does exist, and is very prevalent in Western Queensland, but that it is of relatively very mild type.

Since the last report two papers, written in conjunction with Dr. Breinl, have appeared in the *Annals of Tropical Medicine.*

1. "Changes in the Neutrophile Blood Picture of Arneth observed in Children living in Tropical Queensland."
2. "Observations on the Blood Conditions of Children of European Descent residing in Tropical Australia."

Two papers have been written, in conjunction with Dr. Breinl, and sent for publication :—

1. "Note on Boomerang Leg."
2. "Differential Counts and the Neutrophile Blood Picture of Natives—Adults and Children—of New Guinea."

REPORT FOR THE HALF-YEAR ENDING JUNE, 1915.

By F. H. Taylor.

During the months of January and February, and part of March, I was engaged in completing the investigations into the spread and distribution of *Stegomyia fasciata* (Fabr.), *Culex fatigans* (Wied), and *Anopheles* (*Nyssorhynchus*) *annulipes* (Walker) in the coastal towns of Queensland, between Townsville and Brisbane, for the Department of Quarantine, Melbourne.

This report has been completed and forwarded to the Department.

It has been shown that *Stegomyia fasciata* is a prevalent mosquito in these towns. *Culex fatigans* does not appear to be so widely distributed as the former species, owing to the lack of breeding places at the time of my visits to the towns. *Anopheles* (*Nyssorhynchus*) *annulipes* (Walker) was apparently absent in some of the towns.

A large and representative collection of blood and non-bloodsucking flies were received from Mr. G. F. Hill, Government Entomologist, Darwin. This collection contained a considerable number of specimens of *Culicidæ* and *Tabanidæ*, besides a number of representatives of *Muscidæ Sarcophagidæ* (carrion flies), and several members of the muscoidea.

The mosquitoes contained in the collection were very interesting, as it contained species hitherto unrecorded from Australia, and also some which were previously unknown to the Northern Territory.

The species new to Australia were—*Reedomyia pampangensis* (Ludlow), and *Chrysoconops aurites* (Theobald), and *Skusea uniformis* (Theobald). Those previously recorded from the Northern Territory were *Macleaya tremula* (Theobald), *Hodgesia triangulata* (Taylor), *Culicelsa paludis* (Taylor), and *Pseudoskusea basalis* (Taylor).

The ticks comprised specimens of three species : *Boophilus australia* (Fuller), the cattle tick *Amblyomma triguttatum* (C. L. Koch), and *Aponomma trimaculatum* (H. Luc.), the two latter from reptiles.

The *Tabanidæ* (70 specimens) belong to the genera *Silvius* and *Tabanus,* and apparently contain representatives of new species.

A list of the mosquitoes and ticks is given in the Appendix.

Dr. E. W. Ferguson, of the Bureau of Microbiology, Sydney, forwarded a small but interesting collection for determination.

This collection contained specimens of *Culex frenchi* (Theob.), *Culicada cumpstoni* (Taylor), *Culicida annulipes* (Taylor), which were previously recorded from New South Wales ; also specimens of *Stegomyia atripes* (Skuse), a species described in 1888, and not rediscovered until Dr. Ferguson found it at Milson Island, and Mr. W. A. Thompson at Blackheath, New South Wales. The collection also contained a species new to science, *Culicada milsoni* (Taylor).

A list of the species will be found in the Appendix.

A number of mosquitoes have also been received from Dr. Atkinson, of Perth, but unfortunately they were more or less destroyed by mites.

In so far as they could be determined they represented three species: *Culex fatigans* (Wied), *Culicelsa vigilax* (Skuse), and *Nyssorhynchus annulipes* (Walker).

A further collection of mosquitoes has been received from Dr. T. L. Bancroft, comprising numerous specimens of five different species, a list of which is given in the Appendix.

In addition to the above routine work another paper has been published—

" Contributions to a knowledge of Australian Culicidæ, No. 11," which contains the descriptions of five species new to science. *Stegomyia quasiornata, Neomacleaya australia, Culex mossmani,* and *C. normanensis* from Queensland, and *Culicada milsoni* from New South Wales, besides additional records for previously known forms. The male of *Anopheles* (*Myzorhynchus*) *barbirostris* (v. d. Wulp), var. *Bancrofti* (Giles), is also described for the first time.

Of the above species, by far the most interesting is *Culex mossmani*, which was bred from larvæ at Port Douglas by Drs. Breinl and Priestley, as it brings forward another instance of the relationship of some of the Australian mosquitoes with those of the East. This mosquito is very closely related to *Culex mimeticus*, which is found in the Federated Malay States.

The following paper has been published during the half year :—

" Contributions to a Knowledge of Australian Culicidæ, No. 11,"

and the following are in course of preparation for early publication :—

1. " On a Fly of the Family *Psychodidæ*, a new bloodsucking fly to Australia, and also the first record of the family in Australia."
2. " A New Species of *Tabanidæ*, or March Flies."

This paper will contain the description of a new genus and species, besides several species new to science belonging to the genera *Silvius* and *Tabanus*.

Numerous specimens of mosquitoes have been sent from time to time by Dr. Cumpston, Director of Quarantine, Melbourne, for purposes of determination.

These specimens have represented three species : *Culex fatigans* (Wied), *Scutomyia notoscripta* (Skuse), and *Culicada victoriensis* (Taylor).

APPENDIX.

MOSQUITOES AND TICKS DETERMINED BY Mr. G. F. HILL, DARWIN.

Culicidæ.

Culex occidentalis (Skuse).
Culex sitiens (Wied).
Culex tigripes (G. and C.).
Culicelsa paludis (Taylor).
Culicelsa vigilax (Skuse).
Chrysoconops aurites (Theobald).
Macleaya tremula (Theobald).
Tæniorhynchus uniformis (Theobald).
Stegomyia fasciata (Fabr.).
Stegomyia scutellaris (Walker).
Stegomyia hilli (Taylor)
Scutomyia notoscripta (Skuse).
Skusea funerea (Theobald).
Pseudoskusea basalis (Taylor).
Uranotænia sp.
Reedomyia pampangensis (Ludlow).
Hodgesia triangulata (Taylor).
Nyssorhynchus annulipes (Walker).
Myzorhynchus barbirostris var. *bancrofti* (Giles).

Ixodidæ.

Boophilus australia (Fuller).
Amblyomma triguttatum (C. L. Koch).
Aponomma trimaculatum (H. Luc.).

SPECIMENS DETERMINED BY Dr. FERGUSON.

Culex frenchi (Theobald).
Culex occidentalis (Skuse).
Culex rubrithorax (Macq.).
Culicelsa vigilax (Skuse).
Culicada milsoni (Taylor).
Culicada cumpstoni (Taylor).
Culicada victoriensis (Taylor).
Culicada inornata (Strickland).
Culicada annulipes (Taylor).
Pseudoskusea basilis (Taylor).
Pseudoskusea sp.
Stegomyia atripes (Skuse).
Grabhamia sp.

Specimens presented by Dr. Bancroft represented the following species :—

Culex fatigans (Wied).
Culex occidentalis.
Culicelsa vigilax (Skuse).

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As

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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,

TOWNSVILLE, QUEENSLAND.

London School of Hygiene & Tropical Medicine
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29 JUL. 192

HALF-YEARLY REPORT

FROM

1st JULY TO 31st DECEMBER, 1915.

Presented by Command; ordered to be printed, 22nd *May*, 1916.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JULY TO 31st DECEMBER, 1915.

I beg to report in brief on the work carried out in The Australian Institute of Tropical Medicine from 1st July to 31st December, 1915.

The staff of the Institute consisted of—

The Director, A. Breinl.
Dr. W. J. Young;
Dr. W. Nicoll;
Dr. Priestley;
Mr. F. H. Taylor; and
J. W. Fielding, as Senior Laboratory Assistant.

As during previous periods the work comprised research work on problems connected with tropical disease, tropical hygiene and sanitation, and clinical work in connexion with the tropical ward of the Townsville Hospital.

Dr. Nicoll and Dr. Priestley took their annual leave during the period reported on.

I spent about two months—July and August—travelling through some parts of the Northern Territory with Dr. M. J. Holmes, the Chief Health Officer of the Northern Territory. Several districts were visited and, as far as practically possible, the prevalence and distribution of disease amongst the natives was mapped out. The districts visited, comprised the Daly and Alligator Rivers and Melville and Bathurst Islands.

On account of delays through unforseen circumstances, the results obtained were not as comprehensive as anticipated, but Dr. Holmes and myself were able to make and record several interesting observations. The most striking fact was the comparative absence of malarial fever amongst the natives living undisturbed in their original state. Whereas in a previous journey through the older settled districts malarial fever was found prevalent, especially in mining camps and in and around the stations along the Roper River, no sign of active or latent malaria could be detected amongst the natives of the Daly and Alligator Rivers; at the time of our visit nearly 250 of the natives of Melville and Bathurst Islands—a fair proportion of the total population amounting to approximately 700—were examined and found free from fever. This observation tends to strengthen my previous conception that malaria has in all probability been introduced and had not originally occurred endemically amongst these natives.

Of other diseases yaws was found fairly prevalent.

Cases of leprosy were seen only amongst the natives belonging to the Alligator River tribes, and in the same locality a small number of undoubted cases of gangosa, a disease endemic amongst a great number of various tribes of New Guinea, were encountered.

Cases of another disease, resembling in its manifestations acne, which had been observed frequently in New Guinea, were noticed amongst several of the tribes visited.

Ulcers, generally speaking, were comparatively rare, although a small number of cases were seen, several of them resembling types frequently encountered amongst the New Guinea natives, as, for example, the simple tropical ulcer and the *Ulcus interdigitale destruens*.

Of cosmopolitan diseases syphilis and tuberculosis showed a wide distribution, but had probably been introduced by the newcomers, whites, and Chinamen.

On the whole, the health of the "wild" natives of the Northern Territory has been found excellent when compared with that of natives of other tropical countries, which fact may reasonably be explained by the favorable conditions under which these natives live, whilst in their natural state.

The observations collected during this journey have been reported upon, and will be published as a "Bulletin of the Northern Territory."

During this journey opportunity was taken to collect blood films from native children from "healthy" districts, and are at present being carefully studied from the point of view of the "Arneth Index," and are yielding interesting results when compared with the blood conditions of normal European children living in tropical Queensland and with that of native children in New Guinea, where yaws and malaria are endemic.

After my return from this journey the clinical observation and treatment of the malarial cases which had been sent for treatment and cure to the Institute from Brisbane—32 in number—took up a great deal of Dr. Priestley's and my own time. Careful blood examinations were performed on every case, and the repeated blood examinations for malarial parasites were tedious, as well as costly in time. The senior laboratory assistant, Mr. J. W. Fielding, assisted greatly in the examination of these blood films; thus it was possible to examine a greater number of films, and negative findings based on a number of blood films were more conclusive than a diagnosis based on the cursory examination of a single blood film only.

The results of our observations and an outline of our treatment were recorded in a publication which was sent to the *Medical Journal of Australia*, and will, in all probability, appear shortly.

In collaboration with Dr. Priestley, I tested the efficiency of a new treatment for "Ulcerative granuloma," a disease prevalent amongst the aboriginal population of tropical Australia; advanced cases of this complaint had hitherto been considered incurable. Brazilian observers pointed out a short time ago that tartar emetic administered intravenously had proved a specific cure of this complaint.

The admission of an aboriginal girl suffering from this disease in an advanced stage, offered the desired opportunity to verify the contention of the Brazilian observers which, if correct, would be of great economic and humanitarian importance to a number of natives suffering from this complaint. These natives were previously considered incurable and had, in several instances, been interned in isolation hospitals and kept there until they died a miserable death.

The therapeutical results obtained on this case were very encouraging and fully confirmed the previous observations.

In our patient, the lesions, which were undoubtedly due to ulcerative granuloma —the diagnosis was based on microscopic and histological findings—cleared up remarkably after a course of treatment and the aboriginal girl was discharged from the hospital as cured. Only further observations over a prolonged period will prove whether the "cure" was a permanent or a temporary one.

During the time reported upon, a somewhat severe outbreak of typhoid fever occurred in Townsville and during two months about 52 cases suffering from typhoid fever were admitted to the tropical ward of the Hospital—all fever cases are admitted to this ward.

The diagnosis and treatment of these cases entailed a great deal of laboratory work and attempts were made to confirm the clinical diagnosis, not only by the Widal, but also by cultural tests.

This epidemic enabled Dr. Priestley and myself to make some interesting observations as regards the clinical features of "typhoid" in the tropics and confirmed our previous experiences concerning the protean character of this disease, when compared with typhoid occurring in a temperate climate. In typhoid cases in the tropics, symptoms as rose spots, enlargement of the spleen and diarrhœa are generally absent; the temperature chart in many instances is so irregular that it does not give any help towards the diagnosis. The most interesting point of this outbreak was the relative large number of children and women sufferers, the youngest baby was about eight months old. All the cases proved to be caused by the typhoid bacillus, and no paratyphoid could be isolated from any of the cases.

It is our intention to publish the clinical experiences gained in the near future.

The experiments on the infectivity of the "experimental polyneuritis" in fowls have been brought to a conclusion and have yielded negative results. A note on this work has been sent for publication to the *Journal of Tropical Medicine*. These experiments, however, are being continued on somewhat different lines and it is hoped that I may be able to throw some new light on the etiology of the so-called "deficiency diseases" as Beri-beri, Pellagra, &c.

The experimental work on sprue has, during the time reported on, not given any further results.

Since the beginning of October I have, after the departure of the resident surgeon, taken over part of the work of the General Hospital, assisting Dr. Humphry, the honorary superintendent; this position offers ample opportunity for collecting clinical data for the observations on "White Australia" and enables me to collect material which otherwise would be inaccessible.

The work in connexion with the tropical wards at the Hospital has been rather onerous since the beginning of September, and Dr. Priestley and myself have spent a great deal of time and energy on this work. Besides the malaria and typhoid cases a great number of Dengue cases have been admitted.

Of other tropical cases there was comparatively a small number, which fact may be explained by the continuous dry weather.

Cases treated in the Hospital :—

Febricula	8
Typhoid	70
Malaria	34
Dengue	64
Agchylostomiasis	8
Filariasis	8
Dysentery	6
Sprue	2
Multiple tropical intramuscular abscess	1
Climatic bubo	1
Tape worm	1
Ulcerative granuloma	1
Total	204

PAPERS SENT TO THE PRESS.

Breinl and Holmes—"Medical Report on the Data Collected during a journey through some districts of the Northern Territory."

Breinl and Priestley.—"Notes on the successful treatment of ulcerative granuloma pudendi by means of tartar emetic."

Breinl and Priestley.—"Malaria contracted in New Guinea by members of the Expeditionary Force and its treatment."

Breinl.—"Note on experiments on Polyneuritis in pigeons."

The number of books in our library did not increase considerably. A valuable gift, namely, a set of the *Journal of Tropical Medicine and Hygiene* has been presented to the library of the Institute by Dr. Wilton Love.

Fee for consultation, water examinations and other microscopical tests amounted to £31 19s. 9d.

During the time reported on, Dr. Elizabeth Sweet of the Queensland Department of Public Instruction, spent several weeks at the Institute, working on the Arneth Index of school children of different parts of Queensland.

I am taking the opportunity of pointing out the valuable services rendered during these six months by the senior laboratory assistant, Mr. J. W. Fielding. He not only performed his duties in the ordinary routine laboratory work, but has examined a great number of animals for blood and intestinal parasites for future detailed work.

REPORT OF WORK DONE DURING THE SECOND HALF OF 1915.

By W. J. Young.

Since the last report experiments have been continued upon the antitryptase occurring in the blood serum of normal animals with a view to ascertaining the nature of this body—no definite results have as yet been obtained.

The research into the formation of antibodies to ferments by the injection of ferments into animals has also been continued.

So far two ferments have been used, trypsin and malt-diastase. Commercial preparations of trypsin have been employed as well as trypsin prepared by digesting minced ox pancreas. Hitherto these injections have not been followed by the production of any increase in the antitryptic action of the serum of the animals. With malt diastase very indefinite results have been obtained. In some cases indication of anti-ferment action was obtained, but it was not certain whether these were due to changes in reaction or to the presence of precipitins in the serum, and further experiments are in progress.

The examination of the constituents of the urine of people living in the tropics is being pursued, and a good deal of data collected for comparison.

Experiments are also in progress on the effect of climatic conditions on the metabolism of the body.

Further work on the mechanism of the action of organic arsenic compounds in the treatment of protozoan diseases has had to be postponed, owing to the very great difficulty of obtaining these compounds at present. A paper embodying the results of the work hitherto done on this subject is still in the press.

A few examinations have been made on pathological material submitted to the Institute for diagnosis, and several waters have been analyzed.

During the drought a thorough examination of the Townsville water was made at the request of the town council, and samples were collected at the various sources and a report was submitted to the Council.

The following paper has appeared :—

> "Observation upon the body temperature of Europeans Living in the Tropics." *Journal of Physiol.* 1915, XLIX., 222.

And the following has been accepted for publication :—

> "The fixation of arsenic by the blood serum after the injection of Salvarsan."

REPORT OF WORK DONE DURING THE SECOND HALF OF 1915.

By William Nicoll.

The past half-year has been remarkable for the unusually small number of patients admitted to the Hospital suffering from worm infection. Altogether there have been only sixteen suspected cases of hook-worm and two of tape-worm infection. Amongst those there were only four positive cases of hook-worm infection and one of tape-worm (*Taemiochynchus saginatus*).

This is by far the smallest number of cases of worm infection during any six months since these records were initiated. This circumstance may partly be accounted for by the unusually dry season.

2. Forty-five animals were examined for worm parasites. These included 24 mammals, mostly cattle, sheep and pigs. Only five of these were found to be infected. None of the pigs or sheep were infected, while out of four calves only two were infected. The only heavily infected animal was a bandicoot (*Perameles obesula*) in which five different species of worms were found.

The comparative rarity of worm parasites in domesticated stock in this locality has been commented upon in a previous report but it is possible that sufficient opportunity has not yet been afforded of estimating the exact prevalence of these parasites.

The parasites collected from the calves were such as commonly occur throughout Australia and in Europe and America. The parasites from the bandicoot comprised one species of Nematodes.

Seventeen birds were examined and of these only four were infected with worm parasites. Each of the four were infected with tape-worm and two of them were infected also with round worms.

Two lizards were examined and both were free from parasites.

Of two fish examined one was infected with Trematodes and Echinorhynchs, the other was uninfected.

Only ten of the 45 animals were infected with worm parasites, and these infections comprised eight with tape-worm, eight with Nematodes, and one each with Trematodes and Echinorhynchs.

3. Worm Nodules in Cattle.

Experiments on this subject were continued. Four calves were experimented with, the procedure being similar to that detailed in a previous report. In spite of the most searching examination no trace could be found of worm nodules or of any of the early stages of the parasites. These experiments were discontinued as the expense of procuring calves did not appear to be commensurate with the results obtained.

4. Experiments with hook-worm eggs.

A few further experiments were conducted but these only served to confirm previous results and did not produce anything new. Visits were made to the sanitary depôt and the system of night-soil disposal was studied in detail. So far as could be gathered the system appeared to be satisfactory, not only in disposing of the excreta, but also in preventing the development and spread of hook-worm larvæ. The chief objection to be made is that the process of decomposition of the fæcal matter is rather slow. In some samples taken at random from the trenches, no trace of hook-worm eggs or larvæ could be found though a few non-parasitic worms were observed.

Samples were also taken from a few closets in areas where hook-worms have been found to be prevalent, but in every case the examination proved negative.

Search for indiscriminate scattered fæcal deposits proved disappointing. The few which were found were obviously old and dried up and no trace of hook-worm eggs or larvæ was found in any of them. As mentioned in my full report it is undoubtedly these scattered deposits which are the chief means of spreading infection and every care ought to be taken either to prevent these occurrences or to ensure their speedy removal.

5. Several further experiments were conducted on the life history and development of eye-worms in chickens but these proved abortive. It is evidently difficult to reproduce artificially the conditions necessary for the larval development of these worms. The same may be said with regard to the development of lung-worms in lizards (monitors). Up to the present it has been found impossible to obtain a living specimen infected with the worms and attempts to infect uninfected lizards have proved unavailing.

6. Some progress has been made in dealing with the Filarial worms found in Queensland animals. The subject is a difficult one owing to the lack of satisfactory literature. An additional difficulty is that of preparing the worms in a proper state of preservation.

7. Work is being continued on the parasites of Australian reptiles and it is hoped that a report on these will be issued at an early date.

8. The parasitic worms collected by the Australian Antarctic Expedition have been submitted to me for examination and report and I have devoted a considerable part of my leisure time to these examinations.

PAPERS PUBLISHED.

1. "Trematode Parasites of North Queensland, III."
2. "On Worm Nodules in Calves: some negative Observations and Experiments."

REPORT OF WORK DONE DURING THE SECOND HALF OF 1915.

By Henry Priestley.

During the six months ending 31st December, 1915, a considerable amount of time has been spent in connexion with the cases of malaria and enteric in the Townsville Hospital. This work is reported on by Dr. Breinl.

Investigations into the mechanism of the agglutination reaction have been continued and a paper embodying the results so far obtained has been sent for publication.

The conclusions arrived at were as follows :—

1. The agglutination and the precipitin reactions are essentially the same in nature.
2. The agglutination of bacteria by specific sera is probably due to the formation of altered or "denaturated" serum protein, in and around the bacteria and the subsequent flocculation, by electrolytes, of this altered protein and the bacteria.
3. This altered protein is probably altered serum globulin.
4. The phenomenon of inhibition exhibited by heated agglutinating serum resembles closely the inhibition of agglutination by acids and alkalis.
5. The inactivation of agglutinating serum by heating at temperatures between about 60°–72° C. and the production of zones of inhibition are probably due to the development of inhibitory substances and not to destruction of the agglutinin.

Bacteriological examinations of the Townsville water supply have been made at frequent intervals.

A large amount of routine work—widals, sputum examinations, bacteriological examinations of urine, fæces and water and the preparation of vaccines—has been done.

During the half-year I took my annual leave of six weeks.

REPORT OF WORK DONE DURING THE SECOND HALF OF 1915.

By F. H. Taylor.

I returned to duty from annual leave on 11th June.

A considerable part of the last half-year was occupied in transferring the collection of Australian Diptera (a great portion of which required remounting) to the Insect Cabinet which arrived from London in the early part of this period.

The collection now contains representatives of the following families :—

Simulidæ (true sand-flies), *Chironomidæ* (sand-flies), *Psychodidæ* (owl midges), *Culicidæ* (mosquitoes), *Tabanidæ* (march flies), *Leptidæ*, *Muscidæ* (house flies)—the members of these families are either all blood-sucking in habit, or contain members which have acquired that habit—*Bombylidæ* (bee flies), *Asilidæ* (robber flies), *Syrphidæ* (hover flies), the carniverous species of this family lay their eggs on aphis-infested plants, the larvæ feeding exclusively on the aphis, *Eristalis taenax*, Linn., the European fly which is sometimes the cause of myiasis in man has been received from Sydney, Brisbane and Cairns district, while *E. smaragdi* Walker is a common fly in Townsville where it breeds in household refuse tins. *Diopsidæ* (stalk-eyed flies) so called owing to the eyes being borne at the apex of long stalks which project at right angles to the head, *Trypetidæ* (fruit flies), *Anthomyidæ*, *Dexidæ* (metallic flies), *Sarcophagidæ* (flesh flies) or (sheep maggot flies), *Hippoboscidæ* (louse flies parasitic on birds and mammals), *Nycteribiidæ* (parasitic on bats and flying foxes), *Siphonaptera* (fleas), and *Oestridæ* flies causing myiasis in horses, cattle, and sheep.

The Institute is greatly indebted to Mr. W. W. Froggatt, Government Entomologist, Sydney, New South Wales, for a fine collection of sheep maggot flies, a list of which is to be found in the Appendix.

We have also received a large collection of biting and other flies from the Director of the Imperial Bureau of Entomology, British Museum, N.H. London.

A representative collection as far as specimens are available is being prepared in exchange for the above collection.

Two collections have been received from Mr. G. F. Hill, Government Entomologist, Darwin, Northern Territory, comprising mosquitoes, march flies, scorpions, and centipedes. A preliminary list of determinations is given in the Appendix.

A collection of Culicidæ was received from Mr. F. M. Littler of Launceston, Tasmania, which contained several specimens (most of which are *Stegomyia tasmaniensis*, Str.), from the New River district which lies in an inaccessible portion of the southern portion of Tasmania. The specimens from the above locality were collected by Mr. Twelvetrees, Government Geologist. Amongst other specimens sent by Mr. Littler are two male specimens of *Stegomyia tasmaniensis*, Str., this sex being previously unknown to science.

Dr. Cleland, of Sydney, has also forwarded another collection of Culicidae, and also two species of flies of the family Leptidæ. All the specimens are from Milson Island and the Hawkesbury River District.

The examination of these two collections is incomplete so no list of species is given.

Two papers are in the press and will appear very shortly :—

1. Australian Tabanidæ No. 1.
2. The Psychodidae of Queensland No. 1.

The first paper adds eight new species to the genus *Silvius*, sub-family *Pangoninæ*. This paper will appear in the proceedings of the Linnean Society of New South Wales, probably Part 4, 1915.

The second paper contains the description of a new species of the genus *Pericoma*, *P. townsvillensis* and records the presence of the family *Psychodidæ* in Australia for the first time. The species dealt with is a blood-sucking midge and is apparently the first record of any member of the genus *Pericoma* possessing blood-sucking habits.

APPENDIX.

THE FOLLOWING IS A LIST OF THE SHEEP MAGGOT FLIES PRESENTED TO THE INSTITUTE BY MR. W. W. FROGGATT.

FAMILY SARCOPHAGIDÆ.

Sarcophaga aurifrons Dolesch.

FAMILY OESTRIDÆ.

Oestrus ovis Linn.

FAMILY ANTHOMYIDÆ.

Ophyra nigra Wiedemann.

FAMILY MUSCIDÆ.

Calliphora flavipes.
Anastellorhina augur, F. (C. oceaniae, R.—D.)
Pollenia stygia, F. (C. villosa, R.—D.)
Pycnosoma rufifacies, Macq. (*C. rufifaces* Macq.)
Lucilia serricata Meigen.

THE FOLLOWING IS A LIST OF SPECIMENS SENT BY MR. G. F. HILL AS FAR AS THEY HAVE BEEN DETERMINED.

FAMILY TABANIDÆ.

Silvius frontalis Ricardo.
Silvius hilli Taylor.
Silvius sp. n.
Tabanus rufinotatus Bigot.
Tabanus nigritarsis Taylor.
Tabanus mastersi Taylor.
Tabanus cinerescens W. S. MacLeay.

FAMILY CULICIDÆ.

Myzorhynchus barbirostris, v.d. Wulp. var. *bancrofti* (Giles) Taylor.
Nyssorhynchus annulipes Walker.
Stegomyia hilli Taylor.
Stegomyia sp. n.
Scutomyia notoscripta Skuse.
Macleaya tremula Theobald.
Culicelsa vigilax Skuse.
Culex sitiens Wied.
Lophoceratomyia sp. n.
Uranotaenia sp.

London School of Tropical Medicine
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29 JUL 1

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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

29 JUL. 1

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT

FROM

1st JANUARY TO 30th JUNE, 1916.

Presented by Command; ordered to be printed, 14*th June,* 1917.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JANUARY to 30th JUNE, 1916.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from 1st January to 30th June, 1916.

Dr. W. Nicoll resigned his position as Assistant of the Institute from 31st December, 1915. The staff of the Institute consisted, therefore, of—

The Director, Dr. A. Breinl,
Dr. W. J. Young, Biochemist,
Dr. H. Priestley, Bacteriologist,
Mr. F. H. Taylor, Entomologist,
Mr. J. W. Fielding, Senior Laboratory Assistant.

In the same way as during previous periods, the work comprised research work on problems connected with Tropical Hygiene and Sanitation, and clinical work in connexion with the Tropical Ward of the Townsville Hospital.

Dr. Priestley was absent for about four weeks in January attending a Malarial Conference in Sydney.

As might be expected, the continuation of the war influenced research work greatly, since in many instances glasswares, chemicals, apparatus, and microscopic stains could not be obtained.

Efforts have been made to obtain substitutes for stains, &c., which are in daily use in the laboratory, and cannot be dispensed with, and a great deal of time and labour has had to be expended in order to overcome these difficulties. For instance, Giemsa's stain, which is the routine stain for most of the blood parasites, such as malarial plasmodium, &c., which was supplied by Messrs. Burroughs and Wellcome, is, and has been, for some time, impossible to procure. Dr. Priestley and myself had, therefore, to spend a great deal of time in attempts to produce an effective stain for plasmodium —the preparation of Giemsa's stain is a trade secret—and it was only after long, and at first fruitless, efforts, that a substitute, which is equal to the old stain, was obtained.

During the last three months a number of soldiers, returned from the front and suffering from malarial fever, have been sent to the Tropical Ward of the Institute for treatment; most of these had undergone a more or less severe treatment before their arrival.

The blood examinations of these men, and the search for parasites, took up a great deal of my time. On account of the previous treatment it proved a somewhat lengthy and tiring task to find the malarial parasites in the blood, and in several instances even a prolonged search proved fruitless, and the diagnosis could only be made by taking their clinical history and the blood conditions typical of latent malaria into consideration.

In a few cases the clinical history and the findings led one to suspect the patient to be suffering from Malta fever, and in collaboration with Dr. Priestley, careful bacteriological examination of the blood and urine were undertaken, without, however, finding the Micrococcus melitensis.

In a number of cases bacteriological examination of the fæces was carried out for the presence of typhoid and paratyphoid bacilli; however, in no instance could these bacilli be isolated.

2. The admission of two further cases of advanced ulcerative granuloma gave Dr. Priestley and myself an opportunity to submit the tartar emetic treatment to a further test. One case left the Hospital before a definite cure could be pronounced, and the second case, after the extensive lesions had cleared up, died from consumption.

3. I continued the experiments on "experimental polyneuritis" in rats. A great number of tame white rats were fed on rice, others on bread, meat, corn, and oats respectively. Only the rats fed on rice developed nervous symptoms. The animals became emaciated, and showed paralysis of the hind legs; in the majority, brain symptoms developed, the animals performing rotatory movements and falling to one side. From a number of these affected animals the central nervous system, the nerves of the affected legs, and the internal organs were preserved for histological examination.

4. I made an attempt to elucidate the question of the fate of bacilli when injected into normal and experimental animals. White rats were infected with typhoid bacilli, and the mechanism of the response of the animals to the infection was studied. This work has not progressed very far, and no new facts have yet been obtained.

5. In collaboration with Dr. Priestley, the work on the "Arneth" index has been continued. Blood films collected from native children, living in endemic malarial districts showed a very high index when compared with the blood of white school children reared in North Queensland. It was surmised at the time that this high index was probably due to the prevalence of malarial fever and yaws amongst these New Guinea children. The "Arneth" index of the native children of the Northern Territory corresponded closely to that of the North Queensland school children. This observation proves that the high "Arneth" index is probably due to climatic influence only, and is, up to the present, the only factor in which the blood of children living and reared in the Tropics—no matter whether white or black, as long as they live in a healthy district—differs from that of European children.

6. The survey of the blood parasites of native animals of North Queensland has been continued, and several new species of blood parasites have been discovered, mostly belonging to the species of Hæmoproteus.

7. During this time I took the opportunity of collecting urines from persons attending as outpatients at the Hospital, in order to determine the percentage of physiological albuminuria, in other words, in order to determine what percentage of individuals, who, without apparent symptoms of renal disease, show albumin in their urine. The urines were tested by Dr. Young, and will be reported on by him.

During this period I continued the work at the General Hospital, assisting the Honorary Superintendent, Dr. Humphry.

The work in connexion with the Tropical Ward at the Hospital continued heavy, and the number of patients admitted suffering from tropical diseases was 192.

CASES TREATED AT THE HOSPITAL.

Dysentery	2
Dengue	49
Typhoid	49
Febricula	23
Malaria	37
Beri beri	6
Ulcerative granuloma	2
Leprosy	1
Ankylostomiasis	12
Filariasis	6
Climatic bubo	3
Sprue	2
	192

REPORT OF THE BIOCHEMICAL LABORATORY FOR THE HALF-YEAR—JANUARY TO JUNE, 1916.

By Dr. W. J. Young.

During the hot months an investigation has been in progress into the respiratory metabolism in man under varying atmospheric conditions. The quantities of oxygen absorbed and of carbon-dioxide evolved have been measured, and an attempt has been made to observe the effect of different conditions, such as air temperature, degree of moisture in the air, wind, &c., upon these quantities, and upon the respiratory coefficient. In this investigation, in addition to the readings of the dry and wet bulb thermometers, records have been taken with the katathermometer, recently introduced by Professor Leonard Hill to measure the cooling power of the atmosphere on a body warmed to the average temperature of the human body, and Hill's observations, that the ordinary thermometers fail to demonstrate the conditions which we feel, have been confirmed. Comparisons have also been made indoors in a still atmosphere and outdoors in the wind.

A good deal of information has been collected, and it is proposed to carry out further experiments during the coming hot season.

Further experiments have been made on the production of anti-bodies to ferments, and attempts to immunize animals against ferments have been repeated under different conditions. So far these attempts have still proved unsuccessful. It is proposed to complete these experiments and to publish the investigation.

An opportunity arose to obtain more of the black pigment melanine from the skin of an aboriginal, and another preparation of this substance has been made.

The methods employed by previous workers in the extraction of pigments occurring in skin, hair, &c., are very drastic and are calculated to decompose the product, and it has even been suggested that most of the melanines hitherto obtained from these sources are in reality products of the decomposition of melanine, brought about by the extraction, and not the pigment as it occurs in the tissue. In this preparation, therefore, a method was employed wherein only extremely dilute reagents were used for the extraction, and the danger of decomposition rendered much less. The pigment so obtained is being purified for a study of its chemical and physical properties.

A systematic examination of the urine of outpatients of the Townsville General Hospital is in progress, with a view to finding the incidence of albuminuria amongst residents in the North, who are not suffering from any other symptoms of kidney trouble. This investigation was undertaken to ascertain whether there is any evidence for the belief common amongst medical practitioners in the Tropics, that there is more kidney trouble amongst residents in hot climates than in temperate places. A good deal of data has already been collected, but insufficient as yet for any statement to be made.

In conjunction with Dr. Priestley experiments were commenced upon the effects of exercise upon the pulse rate, blood pressure, and upon the carbonate acid of the alveolar air in a tropical climate. These have been postponed until the next hot season, being interfered with by the rather sudden advent of the cooler weather soon after their commencement.

In addition several chemical examinations of waters have been made and also of pathological material.

REPORT FOR SIX MONTHS—JANUARY TO JUNE, 1916.

By Henry Priestley.

During the half-year a variety of work has been done. Further investigations have been made with Dr. Breinl on the Arneth and differential leucocyte counts in natives, and counts of the blood of a number of healthy natives of the Northern Territory have been made.

A number of attempts have been made to isolate vibrios from the fæces of normal persons, and patients suffering from various complaints, using several of the special media employed for the isolation of cholera vibrios. This work was undertaken at the request of the Director of Quarantine in order to determine whether, in the event of the introduction of cholera into this part of Australia, any vibrios might be commonly found in fæces which might be confounded with the true cholera vibrio. Up to the present no vibrios have been isolated.

At the request of the Director of Quarantine the efficiency of an apparatus for the cresyl disinfection of rooms, in regard to the destruction of mosquitoes in the adult and larval stages, has been undertaken in conjunction with Mr. Taylor. The onset of the cold weather, and the consequent difficulty in obtaining mosquitoes in large numbers, interfered with this work, and only a few experiments on a large scale have been done, but a very large number of mosquito larvæ have now been obtained and the investigations will shortly be recommenced. The experiments so far performed do not justify the forming of any conclusions.

In conjunction with Dr. Young, some observations were begun on the effects of violent exercise, during the hot weather, on the pulse, blood pressure, respiration, body temperature and composition of alveolar air, but with the rather sudden onset of cool weather it was decided to postpone the observations until the next hot season.

A good deal of work has been done in investigating the fungi causing skin disease in residents of Townsville, and in soldiers returned from New Guinea and other places. From two cases of tinea inguinalis in soldiers epidermophyton cruris has been isolated, the cultural and miscroscopical appearance of the fungus being typical.

From a soldier from New Guinea presenting an extensive erythrosquameous eruption a fungus has been isolated which is still under investigation. This fungus is very polymorphic in its growth, and is characterized by the production of a beautiful plum-coloured discoloration of glucose agar under a white or creamy-coloured growth with a short duvet. Microscopically it appears to belong to the group of Achorions, of animal origin. I inoculated myself from a culture of this fungus, and obtained an erythrosquameous patch about 2 cmm. by 1.5 cmm., with five or six minute pustules. A culture has been obtained from skin scales from this patch.

Another variety of fungus has been obtained from two cases of an excematous condition between the toes. In one of the cases there was, in addition, a circinate scaly eruption on the inner side of the thigh which did not spread to any extent and healed spontaneously. From this also was obtained the same fungus. The fungus is a quick-growing one and belongs to the small-spored ectothrid group of trichophytons, but differs in many respects from any of the members hitherto described.

A fungus has been isolated from a case of onchoyeosis, but so far no spores have been observed, and it has been impossible to determine its genus. It is characterized by the well-marked concentric structure of its colonies on Sabourand's agar and glucose agar.

Cultures from various sources of free-living amœbæ have been made with a view to studying the morphology of the amœbæ, and to compare them with human entamœbæ. A latent case of amœbic dysentery is now under observation at the Townsville Hospital.

At the request of the Director-General of Medical Services I attended a Conference in Sydney, in January, to discuss the treatment of returned soldiers suffering from malaria, and the possibility of the introduction of malaria, by these men, into parts of Australia where malaria is hitherto not endemic. A number of recommendations were drafted and forwarded to the Minister for Defence, and in consequence of these, all men returning from New Guinea and a number from other places with malaria are now being sent to Townsville for treatment. A number of men have already been sent here, and have entailed a considerable amount of work, which has been done by Dr. Breinl and myself.

A large number of examinations of sputa for tubercle bacilli, of pus for gonococci, of blood for Widal reaction, and other similar examinations, have been done for the Hospital and for local practitioners.

REPORT FOR JANUARY TO JUNE, 1916.

By F. H. Taylor.

During the past six months the following work has been done.

Investigations into the value of potassium cyanide as a larvacide, on the lines laid down by Ronald Ross and E. S. Edie (*Annals of Tropical Medicine and Parasitology*, Vol. V., page 385, 1911), have been undertaken with varying success. The results have, on the whole, been in conformity with those of Ross and Edie. It has been found that the dilutions cited by these authors are most destructive against the egg, and young larval stages, whilst they are least harmful to the pupal stages of mosquitoes. There is, however, much more required in this direction before definite results are obtained, owing to the number of grades of potassium cyanide on the market.

Some experiments, at the request of the Director of Quarantine, to test the effectiveness of an apparatus for cresyl fumigation of rooms against mosquitoes, their larvæ and other insects (cockroaches, &c.), have been undertaken in conjunction with Dr. Priestley. These experiments were interrupted owing to the scarcity of larvæ in large numbers, but will now be completed as several thousand larvæ have been obtained, from which adults will be bred for the purpose of the experiments. Other details are mentioned in Dr. Priestley's report.

Further material of the fly *Eristalis smaragdi,* Walker, has been obtained, which will enable me to publish its life history.

Complete material of the flesh-fly, *Sarcophaga misera,* Walker, has also been collected, and its life history will be described in the same paper with *Eristalis smaragdi,* Walker.

Attention is also being paid to the larvæ and pupæ of Australian mosquitoes—specimens of several species having been presented to the Institute by Dr. T. L. Bancroft—for the purpose of describing their characters at a later date. Marked differences have already been noted in some larvæ of allied species, the distinctions of the adults being by no means so well pronounced.

Investigations into the relative mosquito density of a given area of this town were commenced toward the end of the period under review, and are being continued at the present time. As this work is done from the egg and larval stages, it entails a considerable amount of work and time before results can be achieved, since the larvæ have to be reared to the adult stage, in most cases, before the species of mosquitoes one is dealing with are known.

Two papers have been sent for publication to the Linnean Society of New South Wales.

1. *Contributions to a Knowledge of Australian Culicidæ, No. III.*, being notes and corrections on previously known forms with descriptions of five species new to science, which are distributed in the following genera :—*Stegomyia, Hulecœteomyia, Culicada, Leucomyia,* and *Lophoceratomyia.*

Both *Hulecœteomyia* and *Lophoceratomyia* are recorded from Australia for the first time. *Hulecœteomyia* occurs in India and the Malay States, whilst *Lophoceratomyia* is distributed through Burma, the Straits Settlements, the Malay States, and New Guinea.

2. *Australian Tabanidæ, No. II.*—This paper is a second contribution to a knowledge of Australian Tabanidæ, which are commonly known as March Flies in Australia, and contains notes on previously known forms and descriptions of a new genus remarkable for its great length in proportion to its width, and twelve new species.

The egg mass of *Silvius Australis,* Ricardo, is also described for the first time.

The new species belong to the following genera :—*Diatomineura, Corigoneura, Silvius, Elaphromyia,* and *Tabanus.*

The following species have been identified for Mr. G. F. Hill, Government Entomologist, Darwin, Northern Territory.

CULICIDÆ.

Pseudoskusea basalis, Taylor.
Reedomyia pampangensis, Ludlow.
Tæniorhtynchus uniformis, Theob.
Chrysoconopsaurites, Theob.
Chrysoconops acer, Walker.
Scutomyia notoscripta, Skuse.
Lophoceratomyia, n.sp.
Culex sitiens, Wied.
Culex fatigans, Wied.
Culicelsa vigilax, Skuse.
Macleaya tremula, Theob.

TABANIDÆ.

Tabanus cinerescens, W. S. Macleay.
Tabanus nigritarsis, Taylor.
Tabanus rufinotalus, Bibot.
Tabanus nemopunctatus, Ricardo.
Tabanus duplonotatus, Ricardo.
And five new species of the genus *Tabanus.*
Silvius frontalis, Ricardo.
Silvius alongatulus, Taylor.
And two new species of the genus *Silvius.*

The following mosquitoes have been identified for Mr. F. M. Littler, Launceston, Tasmania :—

CULICIDÆ.

Culicada demansis, Strickland.
Culicada vandema, Strickland.
Culicada annulipes, Taylor.
Culicada nigra, Taylor.
Culicada cumpstoni, Taylor, var.
Culex fatigans, Wied.
Stegomyia tasmaniensis, Strickland.
Scutomyia notoscripta, Skuse.

The following species have been determined for Dr. J. B. Cleland, Bureau of Microbiology, Sydney :—

CULICIDÆ.

Culex sagax, Skuse.
Culicada, n.sp.
Hulecœteomyia, n.sp.

TABANIDÆ.

Tabanus, n.sp.
Tabanus, n.sp.

Printed and Published for the GOVERNMENT of the COMMONWEALTH of AUSTRALIA by ALBERT J. MULLETT,
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As

1917.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT

FROM

1st JULY TO 31st DECEMBER, 1916.

Presented by Command; ordered to be printed, 14*th June,* 1917.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JULY TO 31st DECEMBER, 1916.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from 1st July to 31st December, 1916.

The Staff of the Institute consisted of—

The Director, A. Breinl,
Dr. W. J. Young,
Dr. H. Priestley,
Mr. F. H. Taylor,
and Mr. J. W. Fielding, as Senior Laboratory Assistant.

As in previous years, the staff of the Institute was engaged partly in research work on problems connected with Tropical Medicine and Hygiene and other questions of scientific interest, and partly on work in connexion with cases suffering from fevers and tropical diseases admitted to the tropical ward of the Townsville Hospital. The latter work was, during the reported period, fairly onerous, as for some time all the beds (twenty in number) and besides two other hospital wards were filled with returned soldiers suffering from a chronic malarial infection, who were sent to Townsville from different parts of the Commonwealth for observation and treatment.

I took my annual leave of six weeks during July and the first half of August, during which time Dr. Priestley acted as Director. Dr. Young was absent from Townsville on his annual leave during the same period.

Dr. Priestley left Townsville at the beginning of December, when he proceeded to Thursday Island, where he spent four weeks as Acting Quarantine Officer during the illness of Dr. Markwell.

Mr. Taylor left for his holidays at the end of August prior to starting a mosquito survey of the irrigation areas of Victoria and New South Wales under the ægis of the Bureau of Quarantine.

During the period in question 72 returned soldiers suffering from chronic malarial fever were admitted to the hospital. The majority of the cases were infected in New Guinea; a small proportion had contracted the disease whilst on active service in Egypt and Gallipoli.

The New Guinea infection proved severe, not so much in causing profound anæmia and general debility, as in its intractibility to treatment and the impossibility of preventing relapses in a number of cases in spite of the severest and prolonged administration of quinine and arsenic.

The greatest difficulty encountered in the successful treatment of the men in question was their reluctance to carry on treatment as advised, after discharge from the hospital. It proved unpractical for more reasons than one to keep the men in the hospital for longer than eight weeks, during which time 30 grains of quinine were administered daily, and about twenty injections of 3 grains of soamin were given at suitable intervals. As anticipated, a great number of the men discontinued treatment the day after their discharge from the hospital, and relapses were therefore unavoidable.

Clinically, the majority of the men showed but slight symptoms, and in a great number of cases even the most painstaking and searching examination of the blood did not reveal either parasites or any of the classical signs of latent infection such as anæmia, mononuclear leucocytosis, or enlargement of the spleen; many of the men had taken quinine at irregular intervals in doses just sufficient to ward off the next attack and for a few days afterwards, only to discontinue treatment as soon as a feeling of comparative health was established again. Even a small number of cases which did not show any sign of malarial infection during their stay in Townsville suffered from relapses after their return south.

In a table are collected the results of the blood counts and differential counts of most of the men treated in the hospital, giving for the majority the figures on admission, and again just before their discharge from the hospital. The perusal of this table bears out the statement of the comparative freedom of the men from severe alterations of the blood which was due to the intermittent treatment, and shows at the same time the remarkable improvement of the blood conditions of the severer cases after their hospital treatment. The intermittent treatment, although beneficial in one way, in reducing the number of parasites and making their deleterious action on the blood condition less harmful, proved disadvantageous in another way, as it made the few parasites which escaped the effect of the quinine more and more resistent, so that they were capable of surviving a severe treatment which under ordinary conditions would have effected a cure of fresh infections without fail.

It was for this reason that the original quinine treatment was augmented by the administration of arsenic in organic form, which has to a certain extent a destructive action upon the parasites in addition to being a powerful stimulant to the blood-forming organs.

As far as possible, the further history of the patients after their discharge from the hospital was traced, but in spite of our urgent request to have blood films of every case, admitted to the different base hospitals, suffering from fever, forwarded to the Institute, only two slides were received, both containing parasites.

Several of the men who had returned from the western seat of war, in whose blood on the occasions of rises in temperature malarial parasites could be detected, other infections, especially Malta fever, were suspected, but in no instance did even the most searching bacteriological examination reveal the presence of *Micrococcus melitensis.*

In the few cases where the clinical symptoms or the previous history aroused the suspicion of a dysenteric infection, the fæces were repeatedly examined for the presence of *Bacillus dysenteriæ* and for *Entamœba histolytica.* Only one man proved to be a carrier of *Entamœba histolytica*, and in his case the employment of the various known means to cure the chronic complaint proved fruitless. At the time of his discharge from the hospital his fæces still contained a great number of amœbæ, in spite of the administration of large doses of emetine and lavage of his bowels with solution of tannic acid, quinine, and nitrate of silver.

(2) In collaboration with Dr. Priestley our researches on sprue were brought to a provisional end, and a paper embodying the results of the investigation, extending over a number of years, will be published shortly in the *Medical Journal of Australia.* We were not able to isolate a specific micro-organism which we could prove to be the causative agent of sprue.

We confirmed the observation of other observers, namely, that yeast cells can invariably be recovered culturally from the lesions and from the evacuations of sprue patients, but did not consider these yeasts to be the etiological factor, but only of secondary importance.

A number of new observations are recorded in this publication. The results of our animal experiments tend to show that the altered conditions of the internal metabolism after removal of the greater part of the pancreas, do not create an individual predisposition in experimental animals for yeasts to become pathogenic and create symptoms, resembling sprue infection in men.

The publication contains, furthermore, a summary of our experiences in the treatment of the complaint and the results of histological examination of the internal organs of two cases which died of sprue in the hospital.

(3) Two cases showing a somewhat unusual clinical manifestation of filariasis were observed in the hospital; one consisted of a skin lesion where the blockage of lymph ducts in the subcutaneous layer gave rise to the formation of small subepithelial lymph cysts which ruptured and discharged from time to time large quantities of chylous fluid. The second case died in the hospital a few hours after admission with the diagnosis " acute abdomen," which the *post-mortem* examination proved to be due to the bursting of a large lymph varix.

(4) Further results have confirmed our previous experiences of the curative effect of tartar emetic in cases of ulcerative granuloma, and three advanced cases treated during the last six months were completely cured.

(5) I undertook some experiments, injecting the intestinal contents of different insects containing *Protozoa* into white rats, in order to ascertain whether *Protozoa*, which live a saprophytic existence in these insects, may become parasites when injected into warm-blooded animals. Up to now, however, these experiments have yielded neither definite nor encouraging results.

During this period I continued to assist Dr. Humphry, the Honorary Resident Surgeon of the Townsville General Hospital, in the routine work of the hospital.

Fees received for examination on account of the Library amounted to £39 5s.

The following number of patients have been admitted during the six months to the Tropical Ward of the Townsville Hospital :—

Dengue	5	Climatic bubo	2
Malaria	78	Tropical muscular abscess	1
Typhoid	18	Elephantiasis	2
Febricula	15	Ulcerative granuloma	5
Ankylostomiasis	12	Keratosis	4
Sprue	4	Lead poisoning	3
Bacillary	1		
Dysentery amœbic	2		159
Filariasis	7		

RESULTS OF BLOOD COUNTS AND DIFFERENTIAL COUNTS OF SOLDIERS SUFFERING FROM MALARIAL FEVER ADMITTED TO THE HOSPITAL, BEFORE AND AFTER TREATMENT.

Hæmoglobin 55 corresponds to normal.

—	Red Blood Corpuscles.	White Blood Corpuscles.	Hæmoglobin.	Polymorphonuclear Neutrophile.	Transitionals.	Large Mononuclear Philes.	Leucocytes.	Lymphocytes.	Mast-cells.
H.	5,530,800	9,466	64	55·4	2·6	6·0	1·4	34·6	..
K., numerous crescents	4,184,000	9,133	46	55·2	2·0	9·2	3·8	31·8	..
K., no parasites ..	5,360,000	8,666	..	..	..	..	..	..	..
L., no parasites ..	5,116,800	5,900	66	52·8	7·8	4·4	1·4	33·6	..
E., no parasites ..	4,915,200	5,000	56	74·4	1·0	0·8	4·8	18·8	0·2
R., no parasites ..	5,481,600	10,500	60	81·0	1·8	1·2	..	14·8	1·2
M., no parasites ..	7,276,800	10,300	65	48·4	1·0	3·8	2·4	44·2	0·2
M., simple Tertian ..	6,368,000	9,233	60	69·0	3·4	1·4	1·4	24·8	..
G., simple Tertian ..	4,416,000	6,633	57	59·0	3·0	8·0	0·8	28·8	0·4
	4,121,600	6,133	42	..	..	..	..	..	..
P., simple Tertian ..	4,982,400	6,333	54	64·2	2·2	8·0	2·2	22·4	1·0
T., no parasites ..	5,260,800	7,666	58	72·0	4·0	2·4	1·2	20·4	..
G., simple Tertian ..	4,652,800	10,000	62	..	..	..	..	..	..
G., simple Tertian ..	5,609,600	9,966	62	..	..	..	..	..	..
S., no parasites ..	5,609,600	5,633	72	68·0	2·8	0·2	1·0	27·6	0·4
H., no parasites ..	5,145,600	8,000	50	64·2	5·0	3·0	1·8	25·6	0·4
	5,232,000	7,800	60	75·8	2·6	1·6	1·4	18·2	0·4
R., no parasites ..	5,100,800	7,666	60	60·2	1·8	0·8	1·2	35·8	0·2
H., no parasites ..	5,542,400	8,633	62	71·8	2·0	0·8	4·2	20·2	1·0
M., no parasites ..	5,187,000	9,166	57	67·0	3·0	6·2	2·6	20·0	3·2
B., no parasites ..	6,112,000	8,866	58	63·6	2·4	5·6	0·8	27·4	0·2
G., simple Tertian ..	3,641,600	5,466	50	67·0	2·6	8·8	1·2	20·2	0·2
	5,292,800	8,800	70	70·6	2·4	2·4	0·6	23·2	0·8
M., simple Tertian pos.	3,692,800	5,233	48	69·0	2·2	9·2	1·2	18·4	..
	6,092,800	9,233	66	72·8	1·6	1·4	1·4	22·2	0·6
H., simple Tertian ..	5,466,100	8,800	62	70·0	2·0	2·2	1·4	23·2	1·2
	5,968,000	7,500	68	69·8	2·6	2·6	0·6	24·4	..
M., no parasites ..	4,656,000	6,900	55	75·6	3·4	4·2	2·4	14·0	0·4
	5,286,400	8,633	70	76·6	2·6	1·4	2·0	17·0	0·4
W., parasites found ..	4,294,400	3,866	55	68·0	1·8	5·6	0·6	23·8	0·2
W., simple Tertian ..	4,351,600	5,233	45	70·6	1·8	3·8	1·8	21·8	0·2
W.	5,734,400	4,666	64	55·6	3·0	6·4	1·4	32·6	1·0
	6,979,200	8,800	66	56·8	5·0	1·6	4·4	31·4	0·8
V.	5,827,200	5,233	70	64·0	2·6	6·6	2·0	24·0	0·8
..	6,035,200	12,300	65	72·4	3·6	1·2	1·6	21·0	0·2
L., simple Tertian ..	5,212,800	9,100	60	63·2	3·0	6·0	3·2	23·8	0·8
	5,811,200	9,900	72	63·8	3·0	1·0	2·2	29·0	1·0
J., simple Tertian ..	4,150,400	12,600	54	64·8	1·0	3·2	2·0	28·0	0·6
	5,347,200	12,500	70	66·0	4·6	1·0	2·4	24·4	1·6
W.	4,742,400	6,666	55	70·0	2·8	1·8	1·2	23·6	0·6
..	4,857,600	6,566	64	72·8	2·0	1·0	1·2	21·6	1·4
C., simple Tertian numerous	4,697,600	15,300	55	50·2	2·6	5·2	3·4	37·4	1·2
	6,012,800	7,166	68	58·0	2·2	2·2	1·8	35·0	0·8
S., simple Tertian ..	..	..	..	59·6	2·6	2·6	1·6	33·0	0·6
	6,278,400	8,800	70	73·4	1·8	1·8	0·4	21·4	1·2
A., no parasites ..	5,059,200	3,966	60	65·6	2·8	2·6	0·4	28·2	0·4
M., no parasites ..	5,331,200	7,066	60	69·8	1·0	3·8	2·0	23·0	0·4
H., simple Tertian ..	5,100,800	3,900	60	78·2	3·6	4·2	1·2	12·6	0·2
	5,913,000	7,666	75	64·2	3·2	1·0	1·6	29·4	0·6

Results of Blood Counts and Differential Counts of Soldiers. &c—*continued.*

—	Red Blood Corpuscles.	White Blood Corpuscles.	Hæmoglobin.	Polymorphonuclear Neutrophile	Transitionals.	Large Mononuclear Philes.	Leucocytes.	Lymphocytes.	Mast-cells.
L., no parasites	5,091,200	5,500	52	70·8	3·2	5·0	0·2	20·4	0·4
	5,299,200	10,800	64	71·8	2·4	2·0	2·0	21·4	0·4
S., simple Tertian	5,644,800	6,666	65	63·4	4·2	5·2	3·0	22·8	1·4
	6,678,400	8,300	74	66·6	1·6	0·4	2·6	28·7	0·4
S., parasites found	6,307,200	7,700	65	66·2	3·6	3·8	3·0	22·2	1·2
A., negative	4,963,200	10,333	55	71·0	2·6	2·4	5·6	18·4	..
M., numerous parasites	3,654,400	5,733	45	62·0	2·2	7·4	5·8	21·6	1·0
A., no parasites	5,059,200	3,966	60	65·6	2·8	2·6	0·4	28·2	0·4
M., no parasites	5,331,200	7,066	60	69·8	1·0	3·8	2·0	23·0	0·4
	5,376,000	8,166	60	71·0	1·6	0·6	2·4	23·6	0·8
M., numerous parasites	2,512,000	7,966	79	71·2	3·8	6·6	0·8	16·4	1·2
	5,692,800	9,366	72	83·4	1·8	1·0	1·2	12·2	0·4
C., negative	4,070,400	4,900	56	60·0	3·6	7·0	1·4	26·6	1·4
C., negative	6,048,000	6,833	60	..	..	..	..	..	..
	6,556,800	8,533	68	78·2	2·6	2·6	0·2	16·2	0·2
G., parasites found	5,616,000	8,100	60	58·2	4·2	5·4	2·6	27·4	..
	5,091,200	7,333	52	64·8	5·0	1·0	1·2	28·0	..
S., no parasites	5,628,800	7,533	60	62·2	2·4	5·2	2·8	29·4	..
G., parasites found	5,452,800	8,000	60	68·8	1·6	4·2	2·2	22·8	0·4
	6,172,800	9,200	70	77·8	2·8	0·6	2·2	15·6	1·0
T., parasites found	5,257,600	4,400	58	78·8	3·4	10·2	4·4	31·8	1·4
	6,966,400	8,900	65	77·4	2·4	1·0	1·0	17·4	0·8
T., numerous simple Tertian	4,371,200	11,600	55	62·2	1·2	5·2	3·2	0·8	27·4
	5,622,400	8,200	72	63·4	2·0	4·0	4·4	25·4	0·8
F., negative	4,441,600	11,033	50	69·8	2·0	4·6	1·8	20·2	1·6
	5,200,000	16,400	60	70·6	3·0	2·0	1·0	23·4	..
R., simple Tertian	5,369,800	6,800	53	68·4	1·8	4·2	..	24·4	..
	5,219,200	13,133	68	70·4	4·8	0·8	1·2	22·6	0·2
R., no parasites	4,966,400	6,300	62	64·2	2·4	4·6	2·2	25·8	0·8
	5,708,800	7,233	70	73·6	2·4	2·0	1·6	20·0	0·4
G., no parasites	4,121,600	6,133	42	65·0	2·8	3·4	..	28·0	0·8
	4,467,200	6,900	54	45·0	2·4	4·0	2·8	45·2	0·6
F., parasites found	4,902,400	7,200	60	63·1	4·3	2·0	7·0	23·0	0·6
	5,959,200	10,566	70	70·6	3·6	0·8	2·0	21·8	1·2
M., no parasites	5,926,400	9,466	70	80·2	1·4	1·6	1·6	14·0	1·2
H., no parasites	5,491,200	5,133	60	74·0	1·6	2·2	1·6	20·4	0·2
	6,316,800	6,466	62	73·8	1·8	0·2	1·6	22·4	0·2
M., no parasites	5,820,800	8,600	70	55·8	3·2	5·8	1·8	32·2	1·2
	5,654,400	8,366	72	67·2	1·0	1·4	1·4	28·0	1·0
C., no parasites	5,635,200	9,300	70	60·0	1·6	5·6	1·6	30·8	0·4
	5,939,200	7,800	72	51·4	3·2	2·6	4·8	37·2	0·8
A., no parasites	5,545,600	7,666	68	61·6	4·2	3·4	1·2	29·2	0·4
	5,552,000	13,666	70	70·0	1·0	1·2	0·6	26·0	1·2
M., no parasites	5,315,200	6,033	65	68·0	1·6	6·0	1·0	23·2	0·2
	6,537,600	6,766	64	74·0	1·4	1·0	1·6	22·0	..
H., numerous simple Tertian	4,326,400	8,900	50	63·8	3·6	3·5	0·5	28·6	..
	5,731,200	7,333	62	61·6	1·8	2·2	1·4	32·6	0·4
C., no parasites	4,665,600	8,000	56	56·0	2·2	4·6	1·0	35·4	0·8
	5,420,800	8,366	62	71·4	1·0	0·2	1·8	25·2	0·4
M., no parasites	5,318,400	7,266	68	55·2	1·6	5·6	2·6	34·6	0·4
	5,289,600	6,466	68	57·8	2·0	0·6	2·8	36·0	0·8
D., simple Tertian	5,267,200	12,500	62	61·4	2·4	7·6	0·6	28·0	..
	6,825,600	12,200	65	56·6	3·2	1·8	1·0	34·4	1·0
D., no parasites	5,475,200	10,466	55	70·2	1·8	6·2	1·4	19·8	0·6
	5,436,800	12,033	60	78·2	2·4	0·6	0·8	17·8	0·2
L., no parasites	5,510,400	5,233	60	60·0	2·2	6·0	3·0	28·0	0·8
	6,748,800	5,500	68	66·8	3·6	0·8	1·8	25·2	1·8
M., no parasites	6,976,000	9,766	68	71·8	2·4	3·8	1·0	17·2	0·8
	6,400,000	8,433	75	67·6	3·0	1·2	2·2	25·4	0·6
C.	4,416,000	14,300	55	..	..	..	..	..	..
	6,732,800	9,466	75	71·4	2·2	3·8	5·4	16·0	1·0
A., parasites found	5,865,600	7,933	58	52·2	2·8	5·4	0·2	39·4	..
	5,715,200	5,700	68	55·4	2·0	1·6	2·2	38·0	0·8
L., negative	5,977,600	8,633	62	66·4	3·4	4·8	2·0	22·6	0·8
	6,224,000	11,866	80	61·4	1·2	1·2	2·0	34·0	0·2
E., parasites found	5,212,800	9,100	58	52·0	2·2	12·0	1·2	32·0	0·6
	6,596,000	8,266	64	65·2	4·0	1·8	0·6	28·0	0·4

REPORT OF THE BIOCHEMICAL LABORATORY FOR HALF-YEAR JULY-DECEMBER, 1916.

By W. J. Young.

In the Biochemical Laboratory the time has been occupied in continuing the following researches, previously commenced.

(1) *An Investigation as to whether Anti-bodies may be produced in the Blood of Animals by the Injection of Enzymes.*—Experiments have been carried out with the two enzymes trypsin and malt diastase. The results as regards the diastase are still indecisive, and further experiments are required. The trypsin experiments have been carried out as far as seems expedient, and a paper on the subject is in course of preparation.

In literature much doubt exists as to the immunization of animals against proteoclastic enzymes. Several investigators have claimed to have produced anti-bodies in the blood of living animals by the injection of the enzymes; others, on the contrary, have failed to do so. The chief difficulty in experiments with proteases consists in the fact that the blood serum of normal animals itself contains a substance which prevents the action of these enzymes. Strictly speaking, this body in normal serum is not a true anti-body, if we adhere to the definition of an anti-body as a substance produced by the injection of a foreign substance, called its antigen, and which acts specifically in antagonism to its own antigen and to no other substance.

It has been shown that this anti-tryptic action of serum varies considerably in amount in different animals, and even varies in the same animal from time to time and under different conditions of health.

Experiments, therefore, were carried out to ascertain whether an increase could be brought about in the anti-tryptic action of the blood serum of the same animal by injecting an active solution of the trypsin. The comparison of the anti-tryptic action after injection was thus made with the normal serum of the same animal, and not with that of a normal animal of the same species as has hitherto been done. As the " anti-body " in normal serum varies, at least two samples of serum from the animal before injection were collected at an interval of a week between each, and both were used for comparison with the serum collected after the injection.

The sera as they were obtained were dried rapidly, as recommended by Chapman, in small quantities at a time at 37 degrees in a vacuum over sulphuric acid. The powder so obtained when dissolved in water and made to the original volume of the serum from which it was derived, was found to have lost none of its anti-tryptic action. The powder was preserved in a closed tube in the ice chest until required for comparison with the serum of the immunized animal also dried in the same manner. All sera were carefully neutralized to litmus paper by addition of acid sodium phosphate before being added to the trypsin, so as to avoid alteration in the reaction of the digestive mixtures.

Several different samples of trypsin were employed, a commercial powder prepared by Grübler, and preparations made from ox or sheep pancreas by autolizing the minced organ in presence of toluene, and dialyzing the filtered mixture until free from the products of digestion. These preparations contained only traces of protein. All solutions of enzyme were rendered sterile before injection, by keeping for a day in presence of toluene and then blowing out the toluene with a current of air first passed through a sterile cotton-wool plug.

For testing the sera, parallel series of mixtures were incubated at 37 degrees for several hours, each containing a constant quantity of the enzyme and an excess of a solution of caseinogen, together with varying quantities of the normal or immune serum. The amount of digestion in each was determined by estimating the nitrogen in the products of digestion which was not precipitated by tannic acid.

The experiments with Grübler's preparation of trypsin were carried out on three goats, injections being given intravenously at intervals of a week, the dose being gradually increased, five injections being given in all.

With the trypsin prepared from ox pancreas, two goats received five intravenous injections at intervals of a week, whilst another received three intravenous injections at intervals of two days.

Another goat was injected intra-peritoneally on three successive days, and after a week's interval the serum was collected.

Further experiments were made with a trypsin preparation from an animal of the same species as that injected, two sheep being injected with a trypsin from sheep pancreas, repeated and large injections being given intravenously.

In none of these cases did the anti-tryptic action of the serum of the immunized animal differ from that of the same animal before injection, to a greater extent than two samples of serum drawn from the same normal animal at different times differed from each other.

From these experiments it is concluded that there is no evidence that a true anti-body to trypsin may be formed by injecting the enzyme into a living animal.

Experiments were made to see if the injection of trypsin was accompanied by any precipitin formation in the serum, and on several occasions it was found that this was the case, and the addition of the immune serum to the trypsin solution produced a precipitate, whereas the serum before injection was incapable of doing so. The formation of precipitins is a property of all foreign proteins, and as this formation was not accompanied by the formation of an increased anti-tryptic action of the serum, one may assume that the antigen was not the trypsin, but some protein accompanying it, and that the precipitin was not an anti-body to the enzyme.

In other cases also the formation of precipitin was examined, but it was not found. These results, therefore, point to the conclusion that the enzyme trypsin is not of the nature of a protein.

(2) *The effects of different Climatic Conditions, Air Temperature, Wind, Open Air, &c., upon the Respiratory Metabolism.*—In almost all of the numerous investigations which have been made into the reactions of the animal to high atmospheric temperatures and high degrees of humidity, these conditions have been produced artificially. The effects of high wet-bulb air temperatures have been studied by Haldane, who found that a wet-bulb temperature of 88-90 degrees F. was the maximum which could be borne for several hours by the human body without distress, when the subject was at rest in still air and was stripped to the waist. A rise of even 1 degree above this temperature was found to produce a rise in the body temperature, which then continued steadily to mount, and if the condition were continued would produce heat stroke. In a good current of air a much higher wet-bulb temperature could be borne, whilst for fairly hard work he gives 80.6 degrees as the maximum wet-bulb temperature in still air.

These experiments were extended by Harvey Sutton, to the gaseous metabolism taking place under high wet-bulb temperatures. His work was done in England in a room which was heated artificially. He found that when the wet-bulb temperature was raised so high as to effect a rise in the body temperature, the latter was invariably accompanied by an increased metabolism thereby causing a further production of heat and so raising the body temperature still higher, a vicious circle being thus set up. The respiratory quotient $\frac{(CO_2 \text{ evolved})}{(O_2 \text{ absorbed})}$ approached unity as the temperature rose, a fact which he attributes to an increased catabolism of carbo-hydrates.

Osborne, working under natural conditions in Victoria (Australia), found that the ventilation of the lung is markedly increased when the air temperature is high, and that the CO_2 expired varied directly as the external temperature. In these latter observations, although on occasions the dry-bulb temperatures were high, very few high wet-bulb temperatures were experienced.

Experiments were commenced in Townsville in the summer of 1916, to ascertain the influence of the different conditions encountered in the Tropics upon the gaseous exchange, the observations being done under normal conditions.

In carrying out the research valuable assistance has been rendered by Mr. J. W. Fielding, who not only acted as one of the subjects, but gave considerable help with the various thermometer and other readings.

The metabolism was studied by the following procedure :—The subject reclined at ease in a deck chair, the canvas of which was removed and replaced by a covering made of an ordinary open-mesh string hammock. After about 30 minutes the subject breathed for twenty minutes through a mouth-piece fitted with inspiratory and expiratory valves into a Zuntz dry meter of the latest pattern, which measured the total volume of air expired during this time. Samples of the expired gases were gradually collected in the sampling tube, which was filled with mercury in place of the acidulated water usually employed, as it was found that the latter absorbed some CO_2, especially if the analysis of the sample was postponed for any time. The sample was measured and analyzed for CO_2 and O_2 by the Haldane apparatus. Whilst the breathing was going on the following readings were made by the assistant every five minutes, and the averages of the five readings so obtained taken as the readings for the whole time :—

1. The readings of the ordinary dry- and wet-bulb thermometers.
2. The temperature of the expired gases in the meter.
3. The temperatures of wet- and dry-bulb thermometers of the air between the skin and the clothing.
4. The times taken for the katathermometers to cool, the dry-bulb from 110 degrees to 100 degrees F. and the wet-bulb from 110 degrees to 100 degrees and 100 degrees to 90 degrees F.
5. The rectal temperature of the subject was taken before and after each experiment.
6. The pulse rate was noted.

The volume of expired gases was reduced to 760 mm. and 0 degree C., and for the calculation of the oxygen absorbed, a correction was made for the differences of volume of inspired and expired air as given by Haldane in his *Methods of Air Analysis*. The percentages of O_2 and of CO_2 in inspired air were taken as 20·90 and 0·03 respectively, the figures given by the Haldane gas analysis apparatus employed.

The experiments were always done in the mornings about the same time after breakfast, which was of the same character, and, in all but the two experiments done in the cooler season, the same amount of clothing was worn, namely, that usually worn during work in North Queensland, a light shirt and cotton trousers, socks, and shoes. Most experiments outdoors were carried out in the shade of a mango tree, and some were done on the verandah of the Institute.

The air temperature during the earlier experiments lay between 80 and 90 degrees F. (26·7 and 33·3 degrees C.) dry-bulb, and over 75 degrees (23·9 degrees C.) wet-bulb. On some occasions the wet-bulb rose above 80 degrees (26·7 degrees C.). In some of the later experiments the wet-bulb was between 60 and 70 degrees, whilst the lowest wet-bulb recorded was 51·2 degrees (10·7 degrees C.).

The Skin-Shirt Temperatures.—The temperatures of the air in immediate contact with the body, between the skin and the shirt, were taken by means of two thermometers, which were prevented from touching the skin by being enclosed in a wire cage ; the bulb of one was covered with a woven cotton glove and dipped in water before inserting.

The skin temperatures were always higher than, and ran roughly parallel to, those of the surrounding air. As one would expect, these are affected to some extent by the amount of wind. This is seen in the following table, a selection of a few observations taken both indoors in a closed room, and outdoors :—

—	Air Temperature.		Skin-shirt Temperature.	
	Dry Bulb.	Wet Bulb.	Dry Bulb.	Wet Bulb.
	°	°	°	°
1. Indoors	83·2	76·0	91·9	82·4
Outdoors, slight breeze	88·9	76·0	91·9	81·3
2. Indoors	86·5	79·2	91·5	84·2
Outdoors, slight breeze	86·4	76·2	90·6	81·8
3. Indoors	88·6	81·8	92·9	88·3
4. Outdoors, slight breeze	85·5	80·0	93·6	83·8
5. Outdoors, almost calm	87·4	80·9	92·5	85·3
6. Outdoors, strong breeze	71·9	56·7	80·6	66·6
7. Outdoors, strong breeze	62·8	58·4	73·3	65·4
8. Outdoors, strong breeze	64·3	51·4	77·0	63·1

The last three were taken during a "cold snap" in June ; on these occasions there was a strong wind blowing and the subject was wearing thicker clothing. On occasions Nos. 7 and 8, even though a coat was worn, the subject felt cold and there was some shivering. These figures show that there was a considerable variation in the skin-shirt temperature in the hotter and cooler months. A number of wet- and dry-bulb skin-shirt temperatures are quoted by Leonard Hill in his report to the English Local Government Board on "Ventilation and the Effect of Open Air and Wind on the Respiratory Metabolism," which were taken in England. With the subject at rest, during the English winter, he obtained readings even outdoors as high as those recorded here in Queensland, but it is to be remembered that his subjects would be wearing very much more clothing. There was much more variation in the readings made by Hill, and the effect of the wind was much greater than in those observed in North Queensland.

The Katathermometers.—It is universally recognised that the wet-bulb thermometer does not always show the conditions which we feel. Any one who has lived in a hot moist climate knows the immense difference in comfort between still and moving air, yet little change may be noticeable in the wet-bulb thermometer readings under the two conditions, the reason being that the wet-bulb thermometer is not sensitive enough to air currents.

For this reason the katathermometer, a thermometer with a large bulb filled with alcohol, has been introduced by Professor Leonard Hill to record the cooling powers of the atmosphere at a temperature in the neighbourhood of that of the body. Two such thermometers are usually employed, one with a bulb kept dry, the dry-bulb katathermometer, and the other, the wet-bulb katathermometer, having the bulb covered with a wet cotton glove. These thermometers (wet- and dry-bulb) are heated to 110 degrees F., and the times which the thermometers take to cool from 110 to 100 degrees and 100 to 90 degrees are observed. The dry-bulb katathermometer measures the rate of cooling by convection, and the wet-bulb katathernometer that by convection and evaporation.

In these experiments the katathermometers have been used in preference to the anemometer as a measure of the effect of air currents as they affect the rate of cooling of the body, since the anemometer only measure the horizontal component of the wind, and eddies and small vortices, which may have a big effect in producing evaporation, are not shown.

A considerable number of readings have been made in Townsville with the katathermometers. One point which has been demonstrated is they are too sensitive to air currents, a fact that has also been observed by Osborne in Melbourne. If a series of readings be taken in rapid succession in still air indoors or on a still day outside, or on a day with a steady wind blowing, fairly consistent times are obtained. On a day with wind coming in gusts, however, great variations may be obtained. A series of readings taken outside with a katathermometer shows that days without gusts of wind are very few and far between, and what would be casually spoken of as a still tropical day is really not so calm as it appears to the senses. For this reason successive readings were made during each experiment, and the average taken as the figure for comparison with that in other experiments. The times taken by the katathermometer to cool through this range of temperature were very much longer than those given by Hill in England, and resembled those taken by him in a hot moist chamber. Considerable variations were observed, the times recorded during the hot season indoors being generally above 200 seconds for the wet-bulb to cool from 110 to 100 degrees F., and generally above 100 seconds outside, whilst the dry-bulb, which was usually only taken between 110 and 100 degrees F., indoors averaged about 300 seconds, and varied considerably outside, the highest reading in the shade being 329 seconds.

The lowest wet-bulb katathermometer reading observed was in June, when 16 and 21 seconds were recorded as the times to cool from 110 to 100 degrees and 100 to 90 degrees, the dry-bulb katathermometer requiring 42 and 54 seconds.

The Gaseous Metabolism.—The figures obtained did not indicate that the carbon dioxide output varied with the increased temperature (wet and dry-bulb). Towards the end of the series of experiments done in April, when the general temperatures were lower, the carbon dioxide varied about approximately the same level as in the hotter season. Nor again was any increased pulmonary ventilation shown with higher temperatures. In one experiment in which the subject sat for half an hour in the sun, no marked increase was observed. The respiratory quotient did not show any rise towards unity with rising temperatures as observed by Sutton in his hot chamber, but varied irregularly in one subject between 0·71 and 0·88 degrees, and between 0·80 and 0·90 degrees in the other. In none of these experiments, however, was any marked variation in the rectal temperatures of either subject noted, the highest recorded being 99·6 degrees F., which may be taken as a normal figure for rest in this climate. In two cases in June, on windy days, with air temperatures dry-bulb, 62·8 and 64·3 degrees, and wet-bulb, 58·4 and 51·4 degrees, the rectal temperature fell during the experiment in both cases to 97·8 degrees, there was marked shivering to which the increased respiratory metabolism noticed was probably due.

Hill found that out of doors in England the greatest metabolism coincided with the greatest rate of cooling as recorded by the katathermometers, and he attributes the curative influence of open air treatment to this increased metabolism. He considers that bracing climatic conditions are those in which the metabolism is increased most by free movement of cool and not too humid air. In his experiments he found that the pulmonary ventilation, the CO_2 output and the O_2 intake were notably larger outdoors than indoors, excepting on cold misty still days, when there was not much change either in the katathermometer readings nor in the metabolism.

In Townsville the katathermometer readings did not show any definite relation with the respiratory metabolism.

Comparative experiments were also made upon a subject who sat for two successive periods on the same day indoors in a still atmosphere and outdoors. It may be interesting to give a table of some of the results, which show that at the air temperatures at which the experiments were done fresh air had no effect on the respiratory metabolism.

—	Katathermometer.		Air Temperature.		Total Air expd.—Lit. per 1 min.	CO_2 evol.—c.cs. per 1 min.	O_2 abs.—c.cs. per 1 min.	R.Q.
	Dry Bulb. 110°–100°. secs.	Wet Bulb. 110°–90°. secs.	Dry Bulb.	Wet Bulb.				
J. W. F.—								
Indoors	322	206	85·9	78·3	5·8	208	253	·82
Outdoors	161	121	86·8	76·7	6·1	219	253	·86
Indoors	316	202	86·1	75·3	6·3	228	267	·85
Outdoors	170	97	86·4	72·3	6·4	231	267	·87
Indoors	282	234	83·0	77·6	6·1	225	268	·84
Outdoors	94	91	83·7	75·9	5·7	211	245	·86
W. J. Y.—								
Indoors	334	230	86·5	79·2	5·3	199	258	·77
Outdoors	141	106	86·4	76·5	5·4	199	245	·80
Indoors	314	217	85·3	78·3	5·8	224	275	·77
Outdoors	162	110	86·7	76·8	6·3	201	264	·76
Indoors	313	212	84·0	75·7	5·15	196	231	·85
Outdoors	123	86	82·2	72·5	5·60	209	237	·88

The experiments as far as they have gone, and with the subject at rest, show that with high temperatures (dry and wet-bulb) which are insufficient to cause a marked rise in body temperature—

(1) Variations in temperature, such as experienced in a tropical climate, produce no definite regular change in the respiratory metabolism.

(2) The cooling power of the atmosphere has not the same influence upon the CO_2 output and O_2 intake as has been observed in the British Isles.

(3) Open air, wind, &c., do not produce any marked effect on the metabolism.

It may be interesting to note that the average oxygen intake at rest in a number of experiments with wet-bulb over 70 degrees were 258 c.c. per minute with one subject, and 250 c.c. with the other. With an ordinary proportion of fat, proteid, and carbohydrate in the food, 1 litre of oxygen produces approximately 4·8 calories of heat, so that the heat production of the two subjects was approximately 72·4 and 74·3 calories per hour. If this heat were neutralized entirely by evaporation of water, it would require the evaporation of approximately 124 and 128 c.cs. of water. As in no case did the external air temperature exceed 90 degrees a considerable amount of this heat would be lost by radiation and convection, so that the evaporation of very much less water would be required by the body to maintain a constant temperature. This includes also the evaporation of water from the lungs, which is passed out in the expired air.

(3) Further work on the composition of the urine excreted in the Tropics has been carried out, especially for the incidence of albuminuria, and a good many more urines have been examined. A paper on the subject is now in course of preparation.

In addition to the research work chemical examinations of pathological material have been made from time to time, and analyses of twelve samples of water have been made for the Quarantine Service, and from other sources.

REPORT FOR HALF-YEAR, JULY–DECEMBER, 1916.

Henry Priestley.

During July and part of August Dr. Breinl took his annual leave, and during this period I acted as Director and assisted at the General Hospital with the out-patient department and with anæsthetics.

The Military authorities continued to send soldiers suffering from malaria to the hospital for treatment until the middle of October, and examination of these patients entailed a considerable amount of work. In connexion with this work I was, in July, gazetted an Honorary Major in the A.A.M.C. Reserve.

(1) The investigation into the mechanism of the agglutination of bacteria by specific sera, which has been in progress for the past two years, has been continued. Attempts have been made to separate that fraction of the serum which is mainly concerned in the agglutination both from the serum itself and from the agglutinated bacteria, but with only partial success. The conditions under which solutions of alum agglutinate bacteria have been investigated in order to determine whether any light could be thrown on the agglutination by specific sera.

(2) Experiments have been performed to determine the value of various chemicals as mosquito larvacides, but beyond showing that the addition of very small quantities of sulphuric acid increased the efficiency of potassium cyanide as a larvacide, no results of practical importance were obtained. It does not seem possible to find any chemical or combination of chemicals which will fulfil all the desiderata—(1) that it shall be cheap; (2) that it shall be effective in concentration; (3) that it shall be relatively innocuous to animals in the concentration used and in the higher concentration which may result from evaporation of the water.

At the request of the Director of Quarantine an apparatus for producing cresyl vapours for destroying mosquitoes has been investigated. It was found that vaporizing 7·5–10 c.c. of cresyl per cubic metre of room space is sufficient to kill all adult mosquitoes if they are not in too well protected places. The effect on mosquito larvæ and pupæ and on other insects is not so good.

Cresyl has a marked advantage over sulphur dioxide for the destruction of mosquitoes, in that the room to be fumigated requires no elaborate preparation and the cresyl vapour does not appear to injure any of the contents of the room. A preliminary report on the results obtained has been sent to the Director of Quarantine, and it is intended to proceed with the experiments under various conditions at an early date.

An elementary course in Bacteriology was given to Captain Streeter, the Medical Officer of the War Service Camp in Townsville. At Captain Streeter's request some investigations were made to determine the most suitable means for purifying the town water supply for the use of the Camp, and a report on the matter was furnished to the Military authorities.

A considerable amount of routine work—examination of sputum for tubercle bacilli, pus for gonococci and other organisms, blood for Widal reaction, fæces for typhoid bacilli, &c.—was carried out for the hospital and for private practitioners.

An article has been written on the "Laboratory Diagnosis of Dysentery" for a Quarantine Service Publication on Dysentery, which it is intended to publish shortly. Two papers have been written with Dr. Breinl—

(1) Sprue in North Queensland;
(2) Two cases of Filariasis.

Early in December I proceeded to Thursday Island, at the request of the Quarantine Department, to relieve the local Quarantine Officer who was suffering from dysentery. My annual leave was taken after leaving Thursday Island.

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HALF-YEARLY REPORTS

FROM

1st JANUARY TO 30th JUNE, 1917,

AND FROM

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JANUARY TO 30th JUNE, 1917.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from January to June, 1917.

The staff consisted of—

A. Breinl, Director;
W. J. Young, Biochemist;
H. Priestley, Bacteriologist; and
F. H. Taylor, Entomologist.
J. W. Fielding acted as Senior Laboratory Assistant.

As in the previous periods, the activity of the Institute comprised research work on problems connected with Tropical Hygiene and Sanitation and other branches of scientific work, and clinical observations in connexion with the Tropical Ward of the Townsville Hospital.

Dr. Priestley was absent during the months of January and February, doing quarantine duties during the first half of January in Thursday Island, and afterwards spending his six weeks' vacation in travelling to Singapore.

During this time I attempted a systematic bacteriological examination of the urine and fæces of most of the fever cases, other than malarial, admitted to the Tropical Ward.

After a careful microscopical blood examination, which excluded malaria, a careful bacteriological investigation of the urine and fæces for the presence of bacteria, belonging to the typhoid and coli group, was performed. In the case of patients suffering from typhoid fever, *Bacillus typhosus* was isolated by means of brilliant green Eosin Agar in eight out of twenty.

The results of the bacteriological examination of the excreta of the cases suffering from "Febricula" was disappointing. One case yielded a strain of *Bacillus entericus*, which was agglutinated by the patient's serum. From another case a *Bacillus asiaticus* (*Castellani*) was isolated, but was not agglutinated by the patient's own serum.

A number of children—seven in all—were admitted to the Tropical Ward suffering from a mysterious fever, which did not strictly correspond to any clinical entity hitherto described. The patients, mostly young children, were admitted in an unconscious state which had, according to the statement of the parents, followed a sudden fit of convulsions. Five cases out of seven ended fatally, and autopsies were performed on each case. The macroscopical lesions of the brain and spinal cord of the first case resembled those of acute anterior poliomyelitis; the microscopical examination of brain and spinal cord of this case confirmed the macroscopical diagnosis. The macroscopic appearance of the other four cases resembled that of the first case, and the tissue will be subjected to detailed microscopical examination.

The spinal fluid of the fourth case, which on examination proved normal, was inoculated into the brain of a monkey—*Macacus rhesus*. This animal developed after twelve days the typical symptoms of experimental acute anterior poliomyelitis, as described by Flexner and his co-workers, and after seventeen days the animal succumbed to the infection after having developed a complete paralysis of his legs and arms.

The brain and spinal cord of this animal showed macroscopically lesions resembling those of the human cases.

The spinal cord of this monkey was ground up and injected intracerebrally into a second monkey, which died after five days, without having shown any typical symptoms. Further experiments will be undertaken, and the tissue of all cases will be subjected to careful examination.

The pathological and experimental evidence tend to prove that at least two of the five cases suffered from a form of acute anterior poliomyelitis, which disease had appeared in Australia in a form clinically different from that previously described. This observation was of especial interest, since similar cases had appeared about the same time in different parts of Queensland and New South Wales, and have been referred to in the *Medical Journal of Australia* as "Mysterious disease."

A short letter, dated 26th May, was sent to this journal, recording the findings. It is my intention to report fully about these cases, giving detailed account of the clinical and pathological observations.

2. I have paid attention to the morphology of the parasite of malaria, as it occurs in Queensland and New Guinea. The parasite of simple tertian malarial fever seems to show morphological variations, according to the locality where the fever had been contracted, especially regarding the number of shizonts in the sporulating forms and in other respects.

3. In collaboration with Dr. Priestley, an investigation of the effects of injections of homologous organ extracts into rats and dogs was begun. The experiments have however, up to now, not yielded any definite results, and will be continued.

During this period 127 patients were treated in the Tropical Ward of the Townsville Hospital—

	Males.	Females.	
(1) Febricula	11	2	
(2) Typhoid	18	6	
(3) Malaria	20	9	
(4) Dengue	9	5	
(5) Endemic glandular fever	1	..	
(6) Agchylostomiasis	16	8	
(7) Filariasis	4	1	
(8) Dysentery	2	..	
(9) Sprue	2	..	
(10) Lead poisoning	1	..	
(11) Climatic bubo	7	..	
(12) Ulcerative granuloma	..	2	
(13) Spider and snake poisoning	..	2	
(14) Leprosy	1	..	
	92	35	Total, 127

REPORT FOR THE HALF-YEAR ENDING 30TH JUNE, 1917.

By W. J. Young.

During the hot months further experiments were performed on the respiratory exchange on the lines reported in detail in the last half-yearly report. The effect of exercise was studied upon the relation of oxygen absorbed to carbon dioxide produced. The apparatus used before was not found suitable for these experiments, and some time was spent in modifying the mouthpiece, so that the apparatus could be carried conveniently on the shoulders during exercise.

A further modification was made in the tube used for collecting the sample for analysis, so that a better average sample could be collected with the increased ventilation of the lungs produced by the exercise. All the tubes and glasswork involved in these modifications had to be made in the laboratory, owing to the difficulty of getting scientific apparatus just now.

The systematic study of the composition of urine has been continued. Analyses have shown some variations in the average quantities of certain constitutents from the figures given in the physiological text books as the average for Europeans.

In this connexion an examination of the sweat has also been attempted, to ascertain what proportion of certain waste products are excreted from the skin. A few samples of sweat were collected and analysed.

Another preparation of melanine from the skin of an aboriginal was made, and is now ready for analysis, and comparison with those previously obtained to see in the first place whether a substance having a constant can be obtained.

The urines of 600 persons have now been examined for the occurrence of albumin, no cases being counted in whom other symptoms of kidney trouble were observed. In these cases a high percentage were found to have albuminuria.

The work on the production of an antibody by the injection of trypsin into the blood of animals has been completed and embodied in a paper ready for publication.

Analyses of eight samples of water have been made for the Quarantine Department, and also from other sources, and a few chemical examinations of pathological material have been carried out.

REPORT FOR THE HALF-YEAR ENDING 30TH JUNE, 1917.

By Henry Priestley.

Further work has been done during the past six months in an attempt to elucidate the mechanism of immunity reactions.

Agglutinating sera were fractionated, and the fractions carefully purified and tested for agglutinating power. As was shown previously, the agglutinin is contained in the globulin fractions, but it was found to be unequally divided between the euglobulin and pseudoglobulin fractions. Removal of the greater part of the protein in the pseudoglobulin fraction by heating at various temperatures was found to leave a considerable proportion of the agglutinin in the clear filtered fluid. Removal of a large part of the globulin by shaking dilutions of the serum in distilled water was found to have little or no effect on the titre of the serum. Experiments are also in progress on the effect of various manipulations on the constituents of a hæmolytic system.

It is clearly recognised now that for the continued well-being of animals, the presence in the diet of some substance or substances other than proteins, fats, and carbohydrates is necessary. These accessory substances or "vitamines," as they are called, are required in minute quantities only. Recent work has made it seem probable that bacteria also require some similar accessory food substances, and investigations on this point are being made. The results so far obtained are inconclusive, largely owing to the difficulty of preparing suitable culture media free from possible accessory substances. It has been possible to demonstrate, however, that alcohol-ether extracts of blood and of milk greatly increase the growth of bacteria.

Observations have been made with Dr. Breinl on the effects of administration of extracts of homologous tissues—kidney and liver—in rats and dogs.

During my visit to Java and Singapore in January, I obtained a number of fresh strains of cholera vibrios, and various differential media were examined to determine the most suitable for occasional use in Australia. Of the media tried Aronson's was found the most satisfactory from the point of view of rapidity of preparation and distinctness of the cholera colonies.

A large number of examinations of sputa, &c., have been made for the hospital and private practitioners.

REPORT FOR THE HALF-YEAR ENDING 30TH JUNE, 1917.

By F. H. Taylor.

I was engaged on the completion of the Anopheline Mosquito Survey of the Murray River Valley in Victoria and South Australia, which I commenced in October, 1916, in the early part of this year, returning to Townsville towards the end of March.

Since my return I have been engaged on a collection of *Tabanidæ* received on loan from the Director of the Queensland Museum. This collection proved very interesting, as it contained a new genus and nine new species. Since this collection was returned to the Queensland Museum a second collection has been received from that institution, but as yet not received attention.

The *Tabanidæ* comprising the entire collection of this family in the Australian Museum has also been received on loan for description and classification. It is a representative one, mainly comprising forms from Southern Australia, and will prove of considerable interest.

I have also commenced work on the habits, life histories, and parasites of the flies of Townsville.

This will entail a considerable amount of detailed experimental work over a period of twelve months to gain as accurate details as possible.

Papers Published :—

(1) "Malaria Mosquito Survey of Irrigation Areas in the Murray River District." Quarantine Service Publication, No. 12.
(2) "Sarcophaga Froggatti sp. n.—A New Sheep Maggot-fly." Bull. Ent. Research, London.
(3) "Australian Tabanidæ (Diptera), No. ii." Proc. Linn. Soc., N.S.W., Sydney.

Papers in the Press :—

(1) "Australian Tabanidæ (Diptera), No. iii."

HALF-YEARLY REPORT FROM 1st JULY TO 31st DECEMBER, 1917.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from 1st July to 31st December, 1917.

The Staff of the Institute consisted of—

The Director, A. Breinl;
W. J. Young, Biochemist;
H. Priestley, Bacteriologist;
F. H. Taylor, Entomologist; and
J. W. Fielding, as Senior Laboratory Assistant.

As in previous years, the Staff of the Institute was engaged in research work on problems connected with Tropical Medicine and Hygiene, and other questions of scientific interest.

During the period I attended the patients admitted to the Tropical Ward of the Townsville Hospital, with the exception of the month of July, when, during my absence in Cairns, Dr. Priestley carried out the work.

The work has been greatly handicapped by the lack of coal gas. For a period of nearly seven weeks, on account of the shipping strike, coal gas was only available for a short time in the morning, and again for a still shorter time in the evening. A great deal of scientific work had to be abandoned for the time, as preparation of culture media, sterilization, &c., was impossible; bacteriological and chemical work was out of the question.

Dr. Priestley resigned his position from 31st December, and left the Institute by the middle of November as his yearly leave of absence was due to him. He carried out the medical examination of recruits for the Australian Forces until that date, and acted as Quarantine Officer.

During the month of July I proceeded to Cairns, accompanied by Mr. F. H. Taylor and J. W. Fielding, in order to undertake, on the invitation of the town council of that city, a malarial survey of the township and the immediate surroundings.

The survey proved of considerable interest, since general conditions in Cairns differed greatly from other tropical towns where malarial surveys had been carried out. In most of the other towns in the tropics the population consists of white men and natives, and as a rule the coloured population acts as reservoir for the infection, in other words afforded mosquitoes an opportunity to become infected and distribute the germs, especially since it is impossible to submit a native population to prolonged and efficient treatment.

In Cairns one is dealing with a white population, which on the whole possesses a full knowledge of the facts about mosquito transmission, and has learned by experience the necessity of prolonged treatment because of the frequent occurrences of relapses.

A campaign in Cairns seemed to offer excellent opportunity for success, because one might anticipate that measures, should they be within the limit of available funds, would be carried out, in case the survey should prove that malaria was in fact a menace to the future welfare of the town.

Cairns is a low-lying coastal town of North Queensland, situated on Trinity Bay, with a population of 5,193 inhabitants.

The Cairns inlet extends some distance inland, with numerous ramifications; the shores are covered with mangroves, and in fact the main part of the town is built on reclaimed land.

The ground gradually ascends to high hills, densely covered with scrub, which surround the town on three sides. The average rainfall is about 90 inches, which is considerably in excess of the rainfall of Townsville.

The township is intersected by swamps, several of them containing salt water, others fresh. The salt-water swamps are covered by a dense growth of mangroves, the fresh-water swamps by fairly dense scrub, with a few tall trees growing amongst the bushes. Swamps are situated between the streets, and closely adjoining the back of the allotments on which the houses are built. On the outskirts of the town many of the houses are surrounded by swamps, which hardly ever dry up completely. The natural situation of the town, therefore, affords ample opportunity for the Anopheles mosquito, to which group the malaria carrier belongs, to breed and propagate.

Nyssorhynchus annulipes most probably acts as malarial carrier in Cairns, and this mosquito has peculiar breeding habits. Its larvæ are practically never found in deep water, but prefer shallow pools, such as occur on the edge of swamps, or in the water collections in holes produced by the hoof marks of cattle and horses. These mosquitoes do not require clear fresh water for breeding purposes; the larvæ are found in the same numbers in collections of dirty water which contain vegetable growth, and find congenial surroundings in brackish and even salt water. The mosquito is not a house mosquito, and does not deposit its eggs in rain-water tanks or water receptacles kept in the houses, but the mosquito flies from the swamp into houses and returns again after feeding to the swamp to deposit its eggs.

The natural situation of Cairns offers ideal opportunities for the propagation of this species of mosquito, conditions which are totally absent in townships as Townsville and Cooktown.

The spread of malaria fever in Cairns can be easily accounted for by the favorable conditions for the propagation of the malaria transmitting mosquito.

The work comprised in the first instance an inquiry into the establishment of the number of persons, as far as possible, in whose blood at the time of the examination malarial parasites could be found, secondly the connexion between the houses where malaria patients were found and the breeding places of mosquitoes, and thirdly the recommendation of measures to exterminate the mosquitoes, or at least minimize their incidence, and the recommendation of an efficient and prolonged treatment for the parasite carriers.

A house to house inspection was undertaken in those parts of Cairns, where, according to the opinion of the local practitioners, a number of cases had occurred, and blood specimens were collected as far as possible from all the members of families who had been suffering from fever within recent times, or whose general appearance, such as paleness, &c., indicated a chronic malarial infection.

In all 657 samples of blood were thus collected and examined microscopically ; out of the total number 88 specimens contained malarial parasites, 45 the parasites of the so-called simple tertian fever, and 43 the parasites of the malignant fever. About twenty blood specimens, although not showing parasites, revealed blood conditions, which justified the conclusion that the persons from whom the specimens were derived had suffered from fever within recent times. The parasites of quartan malarial fever were not encountered.

The microscopical examination proved that 13·5 per cent. of the persons whose blood was examined had actual parasites in their blood and acted as distributing centres for the parasites; in other words, they provided opportunities for mosquitoes to become infected and transmit the infection after a time to others.

It is, however, difficult to draw from this figure a definite conclusion as to the actual number of cases which occur in the township of Cairns in the course of one year. In the first instance the finding of the malarial parasite in a blood film, especially if only present in small numbers, is very difficult, and the parasites are easily overlooked. The success of finding the parasites depends on the skill and on the patience of the observer. Besides, it is a well known fact that in patients the attack is followed by a feverless interval, during which the patient feels comparatively well. The majority of the parasites, during this time, lodge in the internal organs, only a scanty number occurring in the peripheral blood, and the absence of parasites from the blood specimen taken on one occasion only is not positive proof that the person is free from parasites.

It must be kept in mind at the same time that the collecting of blood samples was mainly confined to those parts of the town where cases of malarial fever occurred frequently, and only comparatively few blood samples were obtained from the inhabitants of the centre of the town where fever is rare.

A certain proportion of the blood slides, about 3 per cent., showed an appearance so characteristic of a chronic malarial infection, namely degeneration of a number of the red blood corpuscles and an increase in the precentage of the so called large mononuclear leucocytes, so that in spite of the absence of parasites the blood conditions were characteristic of a chronic malarial infection.

Even the number of fever cases admitted to the Hospital does not give an indication as to the number of fresh cases originating within a given period ; a certain number of them must be considered relapse cases, who leave the Hospital too early or do not continue the prolonged treatment. Moreover, only a small proportion, the most severe cases only, seek admission to the Hospital.

Considering the microscopical infection figure of 13·5 per cent. on the base of previous experiences, it becomes clear that malarial fever is widely spread in Cairns, and that it is necessary to attack the problem of eradicating this infection vigorously and with purpose.

A complete and detailed report on the work, containing suggestions, has been submitted to the Cairns Town Council.

The work on the " mysterious disease " has been continued, and the pathological material collected during the previous six months has been carefully examined. A great number of sections of the brain and spinal cord were cut and stained by different methods. Two of the cases showed microscopically lesions typical of acute poliomyelitis. The pia mater of the brain and spinal cord showed diffuse and perivascular cell infiltration of varying degree, which extended with the vessels into the surface layer and appeared around the blood vessels of the grey substance, where these blood vessels were distended and filled with red blood corpuscles. The grey substance showed a diffuse infiltration with leucocytes and round cells, and here and there a greater number of these cells were collected into small foci, the grey matter around appearing softened.

The ganglion cells showed changes, varying from the earliest stages of degeneration to complete disappearance. Many of them were surrounded by leucocytes, lymphocytes, and large mononuclear cells, possessing a large irregular nucleus with a fine chromatin network, a process known as neuronophagia.

In three cases which were clinically in every respect identical with the others, the only lesions found were a slight but diffuse infiltration, mainly in the grey matter of the brain and spinal cord, which was present, although to a much less degree in the white matter; here and there were numerous hæmorrhages of varying extent.

The investigations proved that the microscopical lesions were identical with those described as occurring in fatal cases of acute poliomyelitis, differing pathologically in one respect only, namely in the involvment of the brain. Small scattered lesions are not uncommonly encountered as autopsy findings in the brain of fatal poliomyelitis cases. The occurrence of extensive cerebral involvement has, however, rarely been demonstrated previously.

This fact, taken in connexion with the successful monkey experiment referred to in the report for the previous six months, proves that the virus which causes the *mysterious* disease gives rise to the same pathological lesions in human beings, and the same symptoms and tissue changes in a monkey as the virus of acute poliomyelitis.

The admission of two patients to the Hospital at the end of December, suffering from the disease in question, will be carefully studied, and the results will be incorporated with the publication which will appear at the beginning of 1918.

The number of patients admitted to the Tropical Ward was 68, suffering from the following diseases :—

Febricula	3	Sprue	4
Typhoid	4	Tape worm	1
Malaria	6	Lead poisoning	1
Dengue	2	Climatic bubo	4
Endemic glandula fever	1	Beri beri	1
Sunstroke	1	Ulcerative granuloma	1
Agchylostomiasis	35		
Filariasis	2		68
Dysentery	2		

The contributions to the Library Fund amounted to £41 17s. 8d. Dr. Wilton Love, of Brisbane, presented the Library with a complete set of the *Journal of Pathology and Bacteriology* and several volumes of the *Journal of Tropical Medicine.*

During the time reported I continued to assist the General Hospital, acting as Resident Medical Officer during the Resident Surgeon's absence on military duties.

REPORT OF THE BIOCHEMICAL LABORATORY FOR THE HALF-YEAR JULY–DECEMBER, 1917.

By W. J. Young.

In the last half-year chemical work in Townsville was very much handicapped by the want of gas. During September and October the strike caused a shortage of coal in Townsville, and the gas company was obliged to curtail the consumption of gas, so that gas was only available between the hours of 8 and 9 a.m. and 5 and 11 p.m. As most of the work in progress demanded the use of heat, recourse had to be had to spirit lamps and oil stoves, which proved very unsatisfactory, and most of the work had to be carried out after 5 o'clock.

The following investigations have been in progress :—

(1) *The Antitryptic Power of Serum.*—That normal blood has the power of hindering the action of trypsin was first definitely noticed by Hahn in 1897. Since then many investigations upon this property have been made, both as regards the nature of the substance in the serum which causes it, and as to the variations which occur in the antitryptic power of serum in health and disease. Two main views have been expressed as to the nature of the substance; the one that it is a true anti-body and acts on the enzyme trypsin in a manner analogous to that in which a toxin is neutralized by an anti-toxin, and the other that it is not a true anti-body, but can be attributed to the absorption of the enzyme by some constituent of the serum in the same way as trypsin is absorbed and its action hindered by digestion with animal charcoal.

Methods have been devised by which a quantitative measurement of the anti-tryptic effect of the sera may be made, the figure so obtained being known as the "anti-tryptic index" of the serum. This index has been stated to be increased in certain diseases, notably in cancer, in acute infections such as pneumonia, typhoid fever, &c., in certain chronic infections such as tuberculosis and syphilis, and in severe anæmias, and the anti-tryptic index has been used as a clinical test in these diseases. The study of the ferment inhibitory substances becomes therefore of great importance.

The methods generally employed for the determination of this index consist in using a trypsin solution which will just digest a case in solution of definite strength in a given time, adding to it a known amount of serum and finding how much trypsin has been rendered inactive by the serum. Another method consists in adding an increasing number of drops of serum to a series of drops of trypsin placed upon a surface of coagulated protein, and finding that amount of serum which will just prevent the trypsin from digesting away and making an impression on the underlying surface of the protein.

Neither of these methods is capable of any accuracy, since they depend upon an end point reaction, and as the quantity of undigested protein falls below a certain relation to the quantity of ferment present, the rate of reaction must fall, so that the rate at which the protein is digested after a time gradually falls and ceases to be a measure of the activity of the ferment.

During experiments previously described, in which it was attempted to increase the anti-body by injections of trypsin into animals, it was noticed that different trypsin preparations seemed to show a different action with the same serum. Accordingly an investigation has been carried out into the anti-tryptic index, using methods capable of more accuracy, in which the amount of digestion of the casein was determined from the nitrogen which escapes precipitation by tannic acid. In every case such an excess of casein was used that the rate of digestion was directly proportionate to the quantity of trypsin present, and the digestion was allowed to extend only over a short interval of time, so that the quantity of available protein should not fall below the critical amount. The rate of digestion was therefore a measure of the tryptic activity.

It was found that if different preparations of trypsin were employed in such amounts that they digested the same quantity of casein in the same time, and to these were added equal amounts of the same serum, the digestion of the casein by the different trypsin preparations was inhibited to very different extents.

The same amount of serum therefore will not always neutralize the same amount of digestive power of different trypsin preparations, and when the anti-tryptic indices of different sera have been compared using different solutions of trypsin, the figures so obtained have no significance. This may explain the varied results obtained by different workers in the attempts to increase the anti-trypsin by injections of trypsin into animals, when the anti-tryptic index of the serum has been done at different times, possibly with a different sample of trypsin.

Even if the same trypsin preparation be employed for comparing two sera the result cannot be more that a qualitative one, since it is shown that if a series of increasing quantities of serum be added to the trypsin, the amount of inhibition of digestion in a given time is not proportional to the quantity of serum added, excepting through a very small range; but the relative inhibition falls off gradually, until an amount of inhibition is reached beyond which further quantities of serum do not have any apparent effect. In other words small quantities of serum have a relatively greater effect than large quantities, and total inhibition cannot be produced, and the comparison of the action of two sera would depend upon whether a small or large quantity of the sera were employed. These experiments show that no reliability is to be placed on the anti-tryptic index of the serum as a clinical test.

Unsuccessful experiments were carried out to see if the different effect of the same sample of serum on two different trypsins might be due to the presence in the trypsin of enzyme so altered that it is incapable of digesting protein, but is still able to enter into association with the anti-body. Such substances have previously been distributed and are known as zymoids.

Investigation of Urines.—The examination of urines for albuminuria of individuals not showing any clinical symptoms of kidney trouble have been completed, and samples from 663 individuals have been examined. These included 360 men and 303 women. The examination was made by three tests—the heat test, the salicyl sulphonic acid test, and the potassium ferrocyanide test—and only those samples which gave all tests were considered positive. The figures obtained showed albuminuria in 57 cases, equal to 8·6 per cent. of the total; 11·7 per cent. were found positive amongst the males, and 4·95 per cent. amongst females. No seasonal variation in the numbers could be detected.

Respiration Experiments.—A few more experiments have been done on the gaseous metabolism under different climatic conditions, both during rest and exercise, and these confirm those previously reported that under tropical conditions air movements, although having a very marked effect upon the comfort of the individual, do not cause any noticeable change in the respiratory metabolism, such as was found by L. Hill and M. Flack in England.

During the half-year five samples of water were analysed, as well as several samples of pathological material.

REPORT FOR THE SECOND HALF-YEAR, 1917.

By Henry Priestley.

During the half-year work has been seriously interfered with by the lack of gas during the day-time.

An attempt has been made to further elucidate the action of serum complement, but without any results worth recording.

Further work has been done to determine whether accessory food substances or " vitamines " are necessary for the development of bacteria on artificial culture media. Difficulty was experienced in obtaining a simple medium which could reasonably be considered practically free from such substances. Various media consisting of simple salts and sugars in solution in water were prepared, in which the growth of bacteria was very slight. Alcohol or ether extracts of such substances as dried milk, beans, whole blood, blood corpuscles, serum, peptone, &c., were prepared, and the effects of the addition of small quantities of watery solutions or suspension of these extracts on the growth of bacteria in the synthetic media noted. It was found that very small quantities of certain of the alcoholic extracts, notably of blood and dried milk, increased the growth of bacteria to a considerable extent.

As an example the addition of a few drops of alcoholic blood extract to a synthetic medium solidified with well-washed agar gave a heavy growth of *B. typhosus*, while the medium without the addition gave merely a thin film of growth.

Ether extracts were without any effect.

A curious result was obtained with a synthetic medium containing, with other salts, NH_4NO_3 for the nitrogen, and glucose 2 per cent. for the carbon, in that a number of organisms which normally produce abundant gas from glucose failed to produce any gas, while still forming a slight amount of acid.

An outbreak of ringworm in the Orphanage was investigated, and *Trichophyton sulfureum* isolated from fifteen children.

A fair amount of routine work of the nature of sputum examinations, examinations of pus for genococci, &c., has been done.

A good deal of time has been spent in the examination of recruits for the A.I.F.

One paper has been written and published in the *Medical Journal of Australia* on " Ringworm and Allied Skin Diseases in North Queensland."

REPORT OF ENTOMOLOGIST, JULY–DECEMBER, 1917.

The month of July was spent at Cairns assisting in a malaria survey of that town.

A considerable number of adult mosquitoes were found, a preliminary list of which is given below.

This collection is a decidedly interesting one, as it contains species of genera only recently brought to light on the mainland of Australia, viz., *Hodgesia* and *Lophoceratomyia*, which are from Africa, Malayia, and Sarawak, though one species of *Hodgesia* has been described from Papua. There are besides members of these genera a number of genera containing obscure forms.

I was enabled to examine the extensive collection of *Tabanidæ* contained in the Australian Museum through the courtesy of Mr. Etheridge, Director and Curator, and the Trustees.

A paper embodying the results of my work on these specimens, comprising 47 species and four varieties, of which twelve species and four varieties are new, will be published in *The Records of the Australian Museum.* This was an interesting collection, as it contained specimens from all the Australian States.

A few of the species had been previously examined by Miss Ricardo, of London, and bore her names. I was thus enabled to compare these species with similar ones contained in the Institute collection for confirmation of determination.

The Queensland Museum, through the late Director, Dr. R. Hamlyn Harris, very kindly favored me with two collections of *Tabanidæ*. The first collection contained 23 species. One genus and ten species were new to science ; the second collection contained ten species, five of which were previously unknown.

Perhaps one of the most peculiar *Tabanidæ* known, certainly from Australia, was represented in these collections, *Pelecorhynchus mirabilis*, Taylor, by both males and females. It is probable that this fly, on further study with other members of the genus, will have to be removed to a new genus closely related to the genus *Pelecorhynchus*.

Mr. Froggatt, Government Entomologist, New South Wales, has continued to forward biting flies for determination. This time the collection comprised *Tabanidæ* collected at Mount Tambourine, South Queensland. The most interesting forms were *Diatomineura violacea* (Macq.), previously known only from the Cairns hinterland, and *Silvius montanus*, Ricardo, a specimen of the latter was kindly presented to the Institute, as it was not previously represented in our collection.

The mosquitoes collected and bred out during the progress of the malaria mosquito survey of the irrigation areas of the Murray River District in Victoria and South Australia in the latter part of 1916 and early 1917 are proving of considerable interest, and will furnish additional records for previously known species, particularly the Anopheline *Nyssorhynchus annulipes* (Walker), which is a common Australian species.

There appear to be a few new species in this collection, which will be dealt with in conjunction with the collection made at Cairns last July.

The life history work of the non-bloodsucking diptera of Townsville is proceeding. It has been seriously handicaped by the exceptionally heavy rains of the present wet season.

The work in hand at present is the life histories of the *Sarcophaga* species carrion-flies. There appear to be eight species here so far, referable to this genus. When they are worked out descriptions of the adults and larvæ with breeding notes will be published. Characters in the stigmata of the larvæ have been found, which will probably be of specific value in the determination of species in the larval form.

The Sarcophaga apparently take the place of another genus of carrion-flies—" Calliphora "—in this locality, for they are common at most periods, while the " Calliphora " are very rare, the adult female *Sarcophaga* appear to be larvivorous, a character probably common to all members of both genera.

One paper, " Australian *Tabanidæ* " (*Diptera*), No. iii., has been published.

Two other papers on " Australian *Tabanidæ* " are ready for the press.

PRELIMINARY LIST OF THE CULCIDÆ TAKEN AT CAIRNS.

Anopheles (*Myyorhynchus*) *barbirostris* (v. d. Walf), var *bancrofti* (Giles).
Anopheles (*Nyssorhynchus*) *annulipes* (Walker).
Stegomyia fasciata (Fabr).
Pseudoskusea similis (Theobald).
Scutomyia notoscripta (Skuse).
Macleaya tremula (Theobald).
Culicelsa vigilax (Skuse).
Culex fatigans (Wied).
Culex sitiens (Wied).
Lophoceratomyia, sp.
Tæniorhynchus uniformis (Theobald).
Finlaya poicilia (Theobald).
Skusea funerea (Theobald).
Skusea uniformis (Theobald).
Uranotænia (represented by five species).
Hodgesia (represented by two species).

LIST OF TABANIDÆ DETERMINED FOR THE AUSTRALIAN MUSEUM.

Pelecorhynchus fusconiger (Walker).
,, *nigripennis* (Ricardo).
,, sp. n.
,, sp. n.
Erephopsis cinerea (Ricardo).
,, sp. n.
,, *gemina* (Walker).
,, *gibbula* (Walker).
,, *submacula* (Walker).
,, *maculipennis* (Macq).
,, *lasiophthalma* (Boisd).
Erephopsis sp. and var. nov.
,, *jacksoni* (Macq).
Diatomineura jacksonensis (Guér).
,, *pulchra* (Ricardo).
,, *brevirostris* (Macq).
,, *gagatina* (Bigot).
,, and three new species
Corizoneura chrysophila (Walker).
,, *fulva* (Macq).
Silvius australis (Ricardo).
,, *?fergusoni* (Ricardo).

List of Tabanidæ Determined for the Australian Museum—*continued.*

Silvius doddi (Ricardo).
,, sp. n.
Ectenopsis australis (Ricardo).
,, *vulpecula* (Wied).
,, ,, var. nov.
Tabanus parvicallosus (Ricardo).
,, *spoliatus* (Walker).
,, *victoriensis* (Ricardo).
,, *macquarti* (Ricardo).
,, *diminutus* (Walker).
,, *sanguinarius* (Bigot).
Tabanus imperfectus (Walker).
,, *circumdatus* (Walker).
,, *vetustus* (Walker).
,, *antecedens* (Walker).
,, *edentulus* (Macq).
,, *hobartiensis* (White).
,, *gentilis* (Erichson).
,, *postponens* (Walker).
,, also four new species and two varieties.

List of Tabanidæ Determined for the Queensland Museum.

Pelecorhynchus fusconiger (Walker).
,, *nigripennis* (Ricardo).
,, *mirabilis* (Taylor).
Erephopsis gibbula (Walker).
Diatomineura auriflua (Don).
,, *testacea* (Macq).
,, *pulchra* (Ricardo).
,, *montana* (Ricardo).
,, *plana* (Walker).
,, *?media* (Walker).
,, *auripleura* (Taylor).
Corizoneura fulva (Macq).
Palimmecomyia celænospila (Taylor).
Silvius stradbrokei (Taylor).
,, also three new species.
Ectenopsis, sp.
Demoplatus australis (Ricardo).
Cœnoprosopon hamlyni (Taylor).
Tabanus hackeri (Taylor).
,, *confusus* (Taylor).
,, *parvicallosus* (Ricardo).
,, *laticallosus* (Ricardo).
,, *rufoabdominalis* (Taylor).
,, *froggatti* (Ricardo).
,, *?edentulus* (Macq).
,, *postponens* (Walker).
,, *?spatiosus* (Ricardo).
,, *?townsvilli* (Ricardo).
,, *dubiosus* (Ricardo).
,, *brisbanesis* (Taylor).
,, also two new species.

List of Tabanidæ Determined for Mr. W. W. Froggatt.

Diatomineura violacea (Macq).
,, near *inflata* (Ricardo).
Silvius montanus (Ricardo).
Tabanus sanguinarius (Bigot).
,, *macquarti* (Ricardo).
,, *victoriensis* (Ricardo).

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LIBRARY

1917-18-19.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,

TOWNSVILLE, QUEENSLAND.

HALF-YEARLY REPORTS

FROM

1st JANUARY to 30th JUNE, 1918,

AND FROM

1st JULY to 31st DECEMBER, 1918.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

HALF-YEARLY REPORT FROM 1st JANUARY TO 30th JUNE, 1918.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from 1st January to 30th June, 1918.

The staff consisted of—

A. Breinl, Director;
W. J. Young, Biochemist; and
Mr. F. H. Taylor, Entomologist.

Doctor Priestley had resigned his position the previous year, and relinquished his duties as Bacteriologist to the Institute in December, 1917. Doctor J. J. Harris, Director of the Microbiological Bureau of the Queensland Department of Public Health, was appointed Bacteriologist to the Institute, and entered upon his duties at the end of February, 1918. From the time of Doctor Priestley's departure until Doctor Harris' arrival, the performing of all the bacteriological routine work of the Institute fell to my share, in addition to my own work, and a great deal of my time was taken up by routine work of various description.

The work comprised in the same way as previously, research work connected with tropical medicine and other branches of scientific work, also clinical work in connexion with the tropical ward of the Townsville Hospital.

The work on the "mysterious disease" has been continued as far as possible, but the experimental investigation was brought to a stand-still on account of the impossibility of obtaining a further supply of monkeys, the only animals susceptible to the disease. Six further cases were observed clinically and pathologically, and the results agreed with those of the previous observations.

Treatment experiments on the line of vaccine treatment were instituted, but had to be discontinued on account of the lack of suitable experimental animals.

In connexion with these findings it would seem of interest to point out that cases of a similar nature to those observed in Queensland occurred in different parts of the world, especially in England and France, and were at first diagnosed as botulism and later as "encephalitic lethargia."

The result of the work has been published in full in the *Medical Journal of Australia*, and a second publication, a continuation of the first, is in preparation.

2. During the time I proceeded on the invitation of Doctor Waite, the Director of the Queensland Hookworm Campaign, to Cairns, where, during a week's stay, I had an opportunity to become familiar with the methods adopted by the International Health Board for the eradication of hookworms. Part of the time was utilized in administering treatment to a number of sufferers.

3. Experiments on the transmission of microfilaria were begun. The results are promising, but are not yet sufficiently advanced to allow of publication.

Experiments on the Physiology of the White Man in the Tropics.

During the summer months, January to April, the staff of the Institute continued the investigations into the physiological activities of a white race living in North Queensland. It has been decided to study the effect of exercise upon the human organism under the influence of high humidity under natural conditions, especially as all records of experiments in this direction were obtained hitherto under artificial conditions.

Several aspects of the physiology of six subjects were studied under varying circumstances, such as brought about by short turns of vigorous exercise, by prolonged exercise, and finally by exposure of two of the subjects to extreme heat. The last experiments were carried out in order to study the physiological effects of the high outer temperature alone, and discriminate thus how far such physiological changes were merely due to exposure to excessive heat and how far they were brought about by the exertion only.

Experiments on similar lines have been carried out in Europe from time to time, and have yielded definite results, and figures obtained in Europe furnish a standard of comparison, which might give an indication whether the human being living in the tropics reacts in a similar manner to heat exposure—at rest and at exercise—as in a temperate climate, in other words, whether life in the tropics brings about a new adjustment (acclimatisation) or not.

The exercise experiments were carried out in two ways. In one series vigorous exercise was undertaken for short periods by lifting the body weight to a certain height, running up and downstairs as fast as possible (about ten times in two minutes); in the second series the exercise was more prolonged, and consisted in walking at a brisk pace for periods varying from half-an-hour to two hours. In the former experiments the amount of work actually performed could be roughly calculated, and at the end results expressed in foot pounds.

The blood pressure, pulse rate, and body temperature (rectal) were taken before and after the exercise, and samples of alveolar air were collected for estimation of its contents of carbonic acid.

The observations proved that the blood pressure increased largely during the exercise, but returned to normal again five or ten minutes after the effort had ceased. Simultaneously a considerable rise in the pulse rate was found, but in the same way as with the blood pressure, the pulse rate returned almost to normal again within a short space of time; the pulse rate was counted for periods of fifteen seconds, and the marked fall began practically after two to three minutes.

Before exercise the pulse rate was estimated with the subject standing up and in a recumbent position, and in some subjects the pulse rate varied greatly according to the position. In one case, *e.g.*, the pulse varied by as much as 24 beats per minute with the alteration of the position, whilst in another case hardly any change was noticed. All the subjects developed during the exercise a considerable dyspnœa. The carbonic acid gas contents of the alveolar air rose considerably on account of the increased metabolism, but shortly after the termination of the exercise it fell for a short time below normal before returning to normal again. This observation makes it clear that vigorous exercise causes a hyperpnœa which causes the equilibrium of the respiratory exchange to become temporarily upset.

Exercise of short duration caused only a small rise in the rectal temperature of the subjects.

The experimental conditions for studying the influence of prolonged exercise were varied. In one experiment a hill, about 1,000 feet high, was climbed during the hottest hours of the day, when the wet bulb temperature approached 80°. At other times walking exercise on the flat was carried on for half to one and a half hours, and the same estimations were performed as mentioned in the previous experiments; in addition, the body weight was recorded before and after exercise, in order to estimate roughly the loss of fluid caused by the evaporation of the sweat.

The results of the observations varied according to the duration of the exercise. The blood pressure generally increased considerably, although not to the same extent as observed after vigorous exercise, returning again to normal within a short interval after cessation of the work. The pulse rate rose at the same time. The carbon dioxide content of the alveolar air showed in most cases only a slight increase; in several instances, however, even a decrease, which decrease is due to the washing out of the carbon dioxide gas from the alveoli of the lungs, on account of the increased respiration rate.

The rectal temperature in every case rose with the duration of the exercise, but increased more quickly in the beginning, and slower afterwards. In several instances rectal temperatures were taken half-way through the exercise and again at the end; whilst the increase during the first half amounted to 1·4° to 3°, in the second half it only increased by 0·3° to 0·7°.

The loss in weight due to the sweating was considerable; one subject lost 1,030 grams in 48 minutes, another lost 1,160 grams during walking exercise extending over 70 minutes. As the subjects were weighed in their ordinary walking clothes, the figures represent only the sweat evaporated, and not the total loss, since the clothing during weighing was still saturated with perspiration.

In a third series of experiments subjects exposed themselves to the influence of extremely high wet bulb temperatures, in a chamber artificially heated. These experiments were performed in order to compare the effects of raised body temperature brought about by artificial means with that caused by prolonged exercise.

It is well known that life in a hot moist atmosphere is only possible if the loss of heat, which is chiefly brought about by the evaporation of sweat, is sufficient to counterbalance the production of heat by the body. Haldane has, in this connexion, shown that there is a critical wet bulb temperature, above which life is impossible on account of the lack of evaporation of sweat, and he places this critical wet bulb temperature at 86° F. wet bulb in still air.

Our subjects were exposed to much higher wet bulb temperatures, 93° to 98° F. in still air for periods varying from 30 minutes to one hour. During the time of exposure the rectal temperature, taken at short intervals, rose slowly and gradually and continued to do so for the duration of the experiment, and reached just before cessation of the experiment from 102° to 103° F. The pulse rate rose concomitantly with the temperature; the difference between the pulse rate standing up and lying down was very marked, amounting in one instance to as much as 40 beats per minute. The changes in the blood pressure were not uniform, showing a fall on one occasion and at other times a rise. The respiration rate increased. These symptoms—increase pulse and respiration rate—are the outcome of the increased body temperature, and do not diffe from those produced by fever. The carbon dioxide content of the alveolar air showed practicall no difference ; the larger output of carbon dioxide due to the increased metabolism was more tha compensated by the increased respiration rate. In one experiment the total volume of air expire increased from 6·4 liter per minute in the beginning to 9·7 liter just before the termination of th experiment.

The loss in weight, due to the loss of water on account of the profuse sweating, was ver marked, and amounted in one observation to nearly 3 per cent. of the total body weight.

In order to ascertain whether the water lost in the sweat was derived from the blood seru or from the tissue, the specific gravity of the blood was estimated by the method of Hammerschlag' Figures obtained before and after the sweating experiment showed only a very slight rise in th specific gravity, which seemed to indicate that only an insignificant portion of the water originate from the blood, and the bulk from the tissue. It must, however, be kept in mind that the metho employed is rather crude and the change not sufficiently marked to draw definite conclusion Further experiments, using more refined methods, will be undertaken.

The results discussed above are far from complete as yet, and form part of an inquiry int the physiological changes of a white working race living under tropical conditions obtaining i North Queensland. The inquiry was undertaken with the purpose of ascertaining if possible an factors which may have a deleterious influence upon the race, and which may possibly be ope to improvement.

Under every-day conditions changes might be present, but only to such a small degree tha their detection would be very difficult. It was therefore decided in our experiments to exaggerat such conditions, so that any changes would be so exaggerated as to become more apparent.

The changes observed in our experiments differed according to the experimental condition The slow exercise experiments show clearly that a great increase in the metabolism takes plac during the first short period after the commencement of the exercise, and that a point is very soo reached after which the metabolism increases only at a much smaller rate. One series of experiment where the subjects walked for 2 miles, were re-examined, and again repeated the same exercis illustrate this point clearly. The body temperature invariably rose considerably during the fir half of the walk, the rise amounting to from 2 to 3 degrees, the blood pressure increased by abou 10 to 20 mm., mercury and the pulse rate increased from about 20 to 37 per quarter of a minute the carbon dioxide content of the alveolar air in the majority of observations rose slightly. Aft the second half of the exercise the pulse rate and the body temperature showed a much slighte increase, and the blood pressure in most instances even decreased during the second half. Th decrease is probably brought about by the dilation of the superficial veins, which contain thus greater quantity of blood, and which leads in consequence to the withdrawal of blood to th periphery and to a lowering of the systolic blood pressure, changes similar to those taking place a hot bath.

Vigorous exercise, extending over a short period only—two to three minutes—increase the metabolism during the effort enormously, but the organism soon returned to normal conditio again, and the metabolic changes therefore did not last long enough to affect the rectal temperatu to any extent.

Experiments in the hot chamber bore out the observation of Haldane, that exposure to high wet bulb temperature caused a rise in the body temperature, since the temperature regulati mechanism became under these conditions ineffectual.

There is a great deal of difference between the effect of exercise on the human organism a tropical and in a temperate climate. Exercise always results in an increased production of hea but the higher outer temperature and the high humidity in the tropics interferes with th cooling mechanism—evaporation of sweat—upon which the body relies for its heat regulation f more in the tropics than in a temperate climate, produces higher body temperatures a consequently a further increase in the metabolism.

It is clear that the increase in the metabolism during the walking exercise (which correspon to manual labour) was leading gradually to the same condition as produced by exposure to th humid heat of the hot chamber ; there is, however, one difference : in the former case the excessi heat was produced internally (by the increased metabolism), whilst in the second instance th excessive heat was produced by external means.

These experiments show that it is impossible to continue heavy manual labour under tr tropical conditions for the same time as in a temperate region without raising the body temperatu to a degree of danger and upsetting entirely the mechanism of the metabolism.

Similar experiments will be continued as soon as the hot weather sets in, and will lea finally to interesting conclusions.

REPORT OF THE BIOCHEMICAL LABORATORY FOR THE HALF-YEAR JANUARY TO JUNE, 1918.

By W. J. Young.

A number of samples of pigment prepared from the skin of Australian blacks have been analyzed. These did not yield any constant results, the analysis of different preparations not agreeing very well.

These preparations contained very varying amounts of ash. No definite formula can as yet be ascribed to the black pigment. It is proposed to submit the preparations to a further purification in the hope of removing the foreign inorganic matter evidently present.

Some time was spent in a joint research with other members of the staff on the effects of exercise on the human body, under conditions of high temperature and high humidity. These experiments are detailed elsewhere.

A few more experiments were conducted upon the effect of air currents upon the total respiration and the respiratory exchange, to complete the series already reported. These were done during the cooler weather for comparison with those found for higher temperatures and humidity.

The results of these showed that below a certain outer temperature increased cooling brought about by moving air increases the respiration rate and the quantity of oxygen absorbed and CO_2 expired. That is to say, below a certain temperature exposure to wind, which increases the rate of cooling of the body, increases the total metabolism (increased the fuel burnt up by the body). At higher temperatures, such as are naturally experienced in the tropics, the rate of cooling of the body does not effect the metabolism in any definite direction. Thus, the body does not consume less food and so compensate for an increased outer temperature. This confirms in another way the work done by Eijkman in the Dutch Indies.

To complete the experiments, observations were carried out also in an artificially heated room under conditions of temperature and humidity which prevented any loss of heat by evaporation, the air being saturated at 97°. Under these conditions a continually increasing amount of metabolism took place, the body temperature rose steadily until a temperature of 103° was reached, and the experiment was stopped. This experiment confirms Harvey Sutton, who obtained a similar result. The experiments tend to show that under high external temperatures the body does regulate its heat balance by cutting off its heat supply, but relies upon physical means for maintaining the constancy of temperature. At lower temperatures the effect of fresh air is, as stated by L. Hill, to increase the muscular tone, which causes increased metabolism, that is to say, that man does not maintain his temperature equilibrium by altering his metabolism, the increased metabolism observed at lower temperatures being really due to exercising the muscles involuntarily.

Experiments have been begun upon the progressive action of trypsin upon casein in which the action of the enzyme is followed simultaneously by methods which record different stages in the degradation of the protein.

A few analyses have been carried out on pathological material, and a few waters have been examined chemically.

HALF-YEARLY REPORT FROM 1st JULY TO 31st DECEMBER, 1918.

I have the honour to report in brief on the work carried out in the Australian Institute of Tropical Medicine from July to December, 1918.

The staff consisted of—

A. Breinl, Director ;
W. J. Young, Biochemist ; and
J. J. Harris, Bacteriologist.

Mr. F. H. Taylor resigned his position as Entomologist in October, 1918, and was appointed Entomologist to the Blow Fly Investigation in sheep, carried out by the Advisory Council of Science and Industry.

The work comprised, in the same way as previously, research work connected with tropical medicine and clinical work in connexion with the tropical ward of the Townsville Hospital,

1. During the time reported a malarial survey of the Innisfail District was carried out. The presence of Doctor Waite and his staff in the Innisfail District was used as an opportunity to carry out a malarial survey, and at the same time combine as far as possible field work in connexion with the lamarial and hookworm campaigns. I was accompanied by Mr. F. H. Taylor as Entomologist, and Mr. J. W. Fielding, Senior Laboratory Assistant.

Unfortunately the whole of the district had been visited a few months previously by a destructive cyclone. It seemed that the extensive damage done to the scrub and trees had changed the natural conditions of the majority of the collections of water, and it could be noticed after a very short time that a mosquito survey was made impossible on account of the absence of mosquito larvae, and in consequence Mr. Taylor returned to Townsville at the earliest opportunity.

Past experiences have shown that in certain regions of the Innisfail District malarial fever has been endemic, judging by the number of cases which have been under treatment in the Townsville Hospital. The majority of the patients hailed from one particular district, the countryside situated near the Mourilyan Harbour line and also that closely adjoining the harbour itself. Many of the patients from other parts of the Innisfail District, when in Townsville for treatment for other complaints, informed me that they and many others suffer every year from malarial fever, and a thorough malarial campaign seemed therefore indicated. The survey of the Innisfail District offered, however, much greater difficulties than the survey of Cairns.

Innisfail is the centre of a large sugar-growing district, and three sugar mills are situated within a few miles of the township, which is situated on the Johnsone River, a few miles inland, and is built on a rise along the river's bank. Around the township are extensive swamps, overgrown by fairly dense undergrowth, with a number of taller trees ; at the time of our visit a great number of the taller trees and much of the undergrowth had been levelled to the ground by the cyclone, leaving large collections of water and a few bared tree trunks bent in the direction of the path of the cylcone.

For the survey the district was divided into three sections, which correspond roughly to the position of the mills, the Mourilyan, the South Johnsone and the Goondi Districts. A railway line connects the Mourilyan Harbour with Innisfail ; for about half the distance on both sides of the railway line there are extensive swamps which have not been reclaimed, and are only sparsely settled ; there is one large saw-mill and a few cane farms. The South Johnsone and Mourilyan Districts extend for nearly 25 miles from the mill, and the cultivated cane land is surrounded by a girdle of virginal scrub land. The rainfall throughout the district is considerable, and the average rainfall for the last 27 years amounts to 151·24 inches.

For carrying out the campaign the same procedure as in our previous Cairns campaign was adopted. It was possible by means of the tram line to reach nearly every house. Thanks to the courtesy of Mr. R. Sloan, the manager of the Mourilyan Mill, and Mr. Henry, in charge of the Ambulance Station at South Johnsone, a motor trolley was put at my disposal, and within a comparatively short time I was able to call at most of the houses and interview the settlers.

For the hookworm campaign, specimen containers with detailed instructions were left at every house. At the same time I attempted to ascertain whether any member of the household had suffered from fever, and, if so, blood specimens were taken from the supposed sufferers and were subjected to microscopical examination. Especial care was taken to obtain blood samples from children, who in endemic areas act mostly as reservoirs for the parasites, thus insuring a continuous reinfection of the mosquitoes.

The Goondi District, situated on both sides of the Johnsone River, consists mostly of typical cane country, and is nearly free from scrub. Numerous blood specimens taken from persons who, alleged to have suffered from "fever," were examined with entirely negative results. In no specimen were any malarial parasites encountered.

The survey of the South Johnstone District yielded the same result, although nearly all houses along the tram line as far as the different termini were visited.

The survey of the Mourilyan District gave more interesting results. A small number of the blood specimens taken contained malarial parasites, and a number of persons were met during the survey who had been patients of the Townsville Hospital, suffering at the time from typical malarial fever showing microscopically malarial parasites in the blood. Simple tertian as well as malignant tertian fever parasites were found in the blood specimens, and one woman, who hailed from this district and was treated in Townsville, had suffered from the "quartan" type of fever ; previous experience had thus shown that all three types of parasites occurred in this district.

During my stay in the scrub country a few patients from "fever" were encountered. The patients had a temperature of about 104° F., and did not present any other physical signs except a raised temperature. A careful physical examination did not reveal any definite signs, and, according to most of the patients, who were quite familiar with the symptoms, the fever lasted as a rule for about a week or longer, and after that time recovery was slow, and many asserted that they suffered from a similar attack of fever every year. Blood specimens were obtained from five patients, all of whom had a high temperature at the time the blood smear was taken, and in spite of the most thorough examination no malarial parasites could be discovered. The negative microscopical examination places it beyond doubt that the fever in the patients in question was not due to the malarial parasite, and the conclusion seems justified that there exists in this district a fever of unknown origin, which resembles malarial fever only in the one respect, namely, the presence of a high body temperature. As the " fever " attacks the same individual nearly every year, it does not seem to confer any immunity, even of short duration as, for example, dengue fever.

Two patients suffering from the same type of fever were carefully observed in the Innisfail Hospital. The symptoms consisted in a continuous fever lasting for five to eight days, followed by a lysis, and the patients were left in a weak and debilitated condition. Careful blood examination did not reveal any parasites, nor any characteristic changes of the percentage and number of the white blood corpuscles. The symptoms of the fever in question do not coincide with those of any of our known fevers, and it is certain that many cases of this fever, where microscopical blood examinations were not performed, have been diagnosed as of malarial origin, and have given rise to the general opinion that malarial fever is prevalent throughout the district.

A few cases of the typical endemic glandular fever, which has been described at first from the Mossman District, were encountered, and many of these cases had been diagnosed previously in the hospital returns as typho-malaria.

The survey has shown that malarial fever is endemic in the inhabitants along the Mourilyan Harbor line, which in part is skirted by densely overgrown swamps, where *Nysorhynchus annulipes* were found breeding in great numbers. There may probably be a few isolated cases on the outskirts of the other district, where dense jungle adjoins the newly cleared sugar land, but its incidence is only very limited. A fever of unknown origin has given in the past the whole of the Innisfail District the evil reputation of being a malarial-infected district.

Nearly 300 blood examinations were performed, and only in three specimens were malarial parasites found; but a number of patients who had been treated in the Townsville Hospital suffering from malarial fever were met.

Doctor J. H. Waite has reported on the prevalence of hookworm infection throughout the district.

2. In connexion with the hookworm campaign of the Rockefeller Foundation, the staff of the Institute, Doctor Harris and myself, ably assisted by Mr. J. W. Fielding, the Senior Laboratory Assistant, have carried an examination of the total number of school children of Townsville, as far as specimens could be obtained, using the same technique as the staff of the Foundation. The following table shows that altogether 2,420 stool examinations were performed, and 183 were found to contain hookworm. With the exception of School V. and the Orphanage, the infection rate was comparatively low. School V. is situated in that district from which, in the past, the majority of the cases hailed which were treated in the hospital :—

——	Total examined.	Hookworm present.	Hymenolepsis.	Ascaris.	Trichocephalus.	Strongyloides.	
School 1 ..	88	7	5	..	2	2	1
School 2 ..	212	10	2	..	4	1	1
School 3 ..	290	9	1	..	1	6	4
School 4 ..	331	8	6	1	8	4	2
School 5 ..	455	81	1	1	3	5	2
School 6 ..	938	22	3	1	2	11	6
Orphanage ..	106	46	9	..	39	6	1
	2,420	183	27	3	59	35	17

3. The work on the transmission of filaria embryos has been continued, but will entail a great deal of further work before being ready for publication.

I took my yearly holiday, and was absent from Townsville from the middle of September until the end of October.

In the middle of November I proceeded to Melbourne in connexion with business of the Institute.

An inquiry as to the blood condition (Differential and Arneth count) of hookworm patients was begun and will be continued.

During the half-year Doctor Young and myself composed a publication on the white race in the tropics with especial reference to Australia.

The number of patients admitted to the tropical ward during 1918 was 167, suffering from the following diseases :—

	Males.	Females.
Febricula	20	6
Typhoid	11	6
Malaria	14	8
Dengue	6	1
Agchylostomiasis	44	24
Filariasis	2	1
Sprue	6	2
Tapeworm	5	..
Heatstroke	1	..
Climatic bubo	2	..
Beri-beri	1	..
Ulcerative granuloma	4	2
Leprosy	1	..

REPORT OF THE BIOCHEMICAL LABORATORY FOR THE HALF-YEAR JULY TO DECEMBER, 1918.

By W. J. Young.

During the half-year July to December a considerable amount of time has been taken up in writing, in conjunction with Doctor Breinl, a paper on the Settlement of Tropical Australia. The paper contains a general summary of the work which has been done in various parts of the world on the physiology of the white man in the tropics, and the bearing of the results upon the settlement of Northern Australia by the white race. In addition, it contains a brief account of the climatology of Northern Australia, and also sections on clothing, housing, and general conditions. This paper will be published shortly.

Work has been continued upon the composition of urine, more expecially, in this case, on the urine passed during the cool season of the year, when loss of water by perspiring is not so great, and consequently more water is secreted in the urine. It was shown that in consequence more chlorides leave the body by way of the urine than in the hot season, when a greater quantity is secreted by the skin in the sweat. A paper on the general conditions of the urine and its bearing upon the work imposed upon the kidneys is now in the press. The work includes also an examination into the composition and physical properties of the perspiration, and this work is still being continued.

A certain amount of progress has been made with the research on the progressive action of trypsin casein, and the course of the action has been followed by different methods which estimate different stages in the degeneration of the protein by the enzyme.

The results of these experiments, although promising, are not yet conclusive, and these experiments are being continued.

In addition, a certain number of chemical examinations have been made of pathological material, such as fæces, and urine, for presence of lead poisoning in children.

REPORT FOR THE YEAR MARCH TO DECEMBER, 1918.

By J. J. Harris.

Owing to the present often unsatisfactory methods of isolating bacillus typhosus from fæces, a series of examinations was made to try and determine which of the methods in everyday use is the most reliable.

In this piece of work the media tested were McConkey's bile salt agar, Endo's medium, Conradi-Drigalski's medium, and brilliant green Eosin medium.

The number of examinations so far made is too small to draw definite conclusions, but for general reliability the last mentioned medium appears to be preferable to the others. It was at first intended to try a modification of Browning's telluric acid medium, but as telluric acid could not be procured in Australia this intention had to be abandoned.

Much time was spent in endeavouring to isolate and identify the strains of Monilia said to be always present in sprue, but, as far as identification was possible, no strain was certainly found in every case of sprue examined, and the conclusion was arrived at that sprue is not directly due any yeast that is found in the fæces.

Several opportunities occurred to investigate the etiology of "kuri-kuri," and special attention was paid to the possibility of an organism, allied to the trichophyton group, being concerned, but no organism whatever could be identified as the causal agent.

A considerable amount of time was spent by me in connexion with the Hookworm Campaign being carried on in Queensland by the representatives of the Rockefeller Foundation, four weeks being spent in Ingham entirely devoted to this work, and much valuable information was thereby gained.

Quarantine duties, especially correspondence, demanded a certain amount of time every week.

In connexion with the "White Australia" question it was thought that an investigation of the fæces of Europeans resident in Townsville, upon the lines of the investigation carried out by MacNeal, Latzer, and Kerr in 1908, might afford information of value.

For the investigation the fæces of four members of the staff of the Institute were examined. Of the four, not one had been resident here for less than five years, so that it was concluded that a stable intestinal flora would in that time have established itself, and the hope was entertained that some change would be found that would serve to throw some light on the question of metabolism in the tropics. In addition data were sought for comparison with the results of MacNeal, in order to ascertain in what way, if any, and to what degree the tropical fæcal flora of Europeans in Townsville differed from the flora of a temperate climate.

The results are not strictly comparable, for in MacNeal's investigations the material was obtained from men on a measured and somewhat restricted diet, while here no attempt was made to in any way interfere with the accustomed food of the subjects either in quantity or quality.

The results obtained fall into two divisions; first, the direct examination, including the direct microscopic enumeration of the bacteria, the gravimetric estimation of bacteria by the Strassburger method, and the determination of the relative numbers of morphologically different bacteria by examination of Gram stained films; second, the estimation of the number of bacteria capable of growing aerobically on ordinary agar, the identification as far as possible of organisms capable of growing in bile salt glucose and lactose broth, and the determination of bacteria capable of growing on ordinary agar plates of different degrees of acidity and alkalinity.

COLLECTION OF MATERIAL.

Each stool was passed directly into a sterile earthenware vessel, no precaution being taken against the accidental contamination of the fæces in passing from the anus to the container. Care was taken to exclude all urine. Immediately the motion was passed the vessel was covered and carried into the room where the examination was straightway begun.

PREPARATION.

As soon as received a note was made of the rough microscopic appearance of the sample, after which the specimen was mixed by rubbing with a heavy glass rod against the side of the vessel, during which observations were made as to the presence of vegetable particles such as fibres and seeds.

SUSPENSION.

When thoroughly mixed, a 1 in 100 suspension of the fæces was made, and from this all the subsequent bacteriological observations were made.

In this the method of MacNeal was used, and, except when there was a large proportion of vegetable matter present, it was found very quick and satisfactory.

The method is as follows:—"A perfectly clean, dry, sterilized glass-stoppered measuring flask of 50 c.c. capacity is first accurately weighed. Then by means of a sterile glass rod drawn to a point, ½ gram of fæces is transferred to the flask and deposited on the inside of the neck, the quantity being increased or diminished as required until the necessary amount is obtained. The weight is observed with the glass stopper in position, and an amount within 1 mg. of the required weight is considered sufficiently accurate.

About 10 c.c. of sterile ·75 saline is transferred to the flask by means of a Pasteur bulb pipette, and the fæces rubbed up in the neck of the flask with a second clean sterile glass rod. Further salt solution is then added, the glass rod and the neck of the flask being well washed by it as it runs in, until the flask contains about 20 c.c.

The flask is then stoppered and vigorously shaken for a few minutes, then inverted so that unsuspended solid particles settle into the neck against the glass stopper. The flask is then slowly erected so that the liquid flows from the neck back into the body of the flask leaving the solid bits in the neck where they are easily crushed with the glass rod. The flask is again shaken, and the solid particles allowed to settle in the neck, where the crushing process is repeated. This procedure is repeated until there remain no microscopic bacterial masses, recognised as opaque brown lumps.

The visible pieces of tissue will then be washed clean, so that their character is easily recognised, and the bacteria have been washed away and suspended in the liquid.

The flask is now violently shaken for five minutes to break up microscopic bacterial clumps. Further salt solution is then added up to the 50 c.c. mark, the glass rod and the neck of the flask being washed clean during the process, and after final vigorous shaking the suspension is ready for use.

QUANTITATIVE DETERMINATION.

The total quantity of bacteria was estimated by two different methods, though for comparison an additional estimation by the ordinary plate method was made.

The two different methods were a modified Eberle-Klein method and the modified Strassburger gravimetric determination as practised by MacNeal.

THE MODIFIED EBERLE-KLEIN METHOD.

In this the procedure followed by MacNeal was used, the same proportion of bacterial suspension, gelatine, and aniline water gentian violet being employed. After well shaking and allowing to stand five minutes, a platinum loop of known capacity was used to take a loop of the mixture.

In making the smears MacNeal here used two cover slips to spread the liquid, but on trying this method I found that the resulting smears were too uneven, so I discarded it. In its place I used the ordinary method of making a blood smear ; that is, a thoroughly clean slide was taken, and the loop of mixture deposited towards one end. The end of another clean slide was then used to make the smear in the usual way. In this way, provided the capacity of the loop was not too great, a good even smear was obtained, and the examination showed there was but little tendency to heaping of the bacteria. The films were then accurately measured by a millimeter rule, and after fixing in the flame were examined.

Before examining the length of the smear, and the breadth of the smear were divided by 100, and the examination was begun at one corner of the smear, and each new field was reached by moving the slide lengthwise for one-hundredth of the length of the smear, and crosswise for one-hundredth of the width of the smear. In this way 100 fields were examined, beginning at one corner of the smear and ending at the diagonally opposite corner. Using a B. and L. 1-in. ocular, and 1/12th-in. oil immersion lens, with a diaphragm in the ocular having a square aperture of a convenient and known size, the number of bacteria in the film was approximately ascertained and knowing the capacity of the loop, the number of bacteria per gram of fæces was arrived at.

GRAVIMETRIC DETERMINATION.

In this determination the method of Strassburger as modified by MacNeal was used, but from the nature of the process a figure of very doubtful value is obtained. Condensed the technique is as follows :—The examination is begun as soon as the 1 in 100 suspension is made. An amount of fæces (2·5 grams) is carefully weighed into a previously weighed centrifuge tube. The subsequent treatment of this is a process of fractional sedimentation in the tube, by means of a centrifuge. For this the fæces, by rubbing with a sterile glass rod, are suspended in ·5 per cent. hydrochloric acid, after which the tube is centrifugalized at a high speed (hand centrifuge) for five minutes, when the supernatant liquid is pipetted off into a clean sterile beaker. The remaining sediment is emulsified in more hydrochloric acid, centrifugalized, and the liquid removed as before and added to that in the beaker.

This is repeated until the sediment remaining in the tube shows on microscopic examination but few bacteria. MacNeal speaks of securing in this way a final sediment entirely free from bacteria, but with a hand centrifuge this is not possible.

With the fluid in the beaker, containing practically all the bacteria in the 2½ grams of fæces, the whole process is repeated, and finally there are 250–400 c.c. of liquid in the second beaker, and the sediment in the second series of tubes is discarded.

I find that this sediment, no matter how thoroughly it is washed, contains a number of the larger and presumably heavier bacteria. To the fluid in the second beaker, an equal quantity of alcohol is added, and the beaker is placed in a water bath at 60 C. until evaporation has reduced the fluid to 40–50 c.c. To this 200 c.c. of alcohol are added, and the beaker allowed to stand for 24 hours.

At the end of this time the bacteria have settled, so that the supernatant liquid can be pipetted off without any loss of solid matter. The remainder is poured into a centrifuge tube, care being taken to remove with a rubber-tipped glass rod all material adhering to the side of the beaker. After centrifugalizing, the clear alcohol is pipetted off. Absolute alcohol is added, the sediment thoroughly mixed and allowed to stand one hour, when the tubes are centrifugalized again.

The tubes are now filled with ether, tightly corked, well shaken, and allowed to stand for 24 hours.

The following day the ether is removed, the sediment washed with absolute alcohol by stirring with a glass rod and centrifugalizing. The contents are then transferred to a weighed crucible by washing the tube out with alcohol and carefully rubbing with a rubber-tipped rod; the crucible is then placed at 50 C. until all visible liquid has disappeared, when it is dried to constant weight at 100–103 C.

DIFFERENTIAL BACTERIAL COUNT.

To make the results as comparable as possible, the procedure adopted by MacNeal was followed in its entirety, except that the smears were made on clean slides in place of cover slips, for reasons already stated.

A thin even smear having been obtained, it is dried in the air and fixed over the flame· Freshly-made anilin-water gentian violet is poured on and allowed to remain for three minutes› after which it is poured and drained off with filter paper.

Lugol's iodine solution is poured on and allowed to remain for two minutes. This is then drained off and the slide dried between filter paper.

To decolourize, the slide is immersed in aniline xylol for 30 seconds, dried between filter paper, and further decolourized by immersion in methyl alcohol for five seonds. It is then washed in water, counterstained in dilute safranin for some seconds, and finally washed in water and dried in the air.

WEIGHT OF DRIED FÆCES.

After the fæces are weighed for the gravimetric estimation of bacteria, a quantity (2·5 grams) was weighed out in a porcelain crucible of known weight. The crucible was then placed in the oven at 70 C. till all visible moisture had disappeared, then the temperature was raised to 102 C. for two hours, after which the crucible was placed in the desiccator. Next day it was again placed in the oven at 102 C. for two hours, and placed in the desiccator. This was repeated from day to day until a constant weight was obtained.

The results are as follows :—

TABLE I.

Differential Counts.

—	I.	II.	III.	IV.
Number counted	3,164	3,079	3,083	3,076
Colon type .. .. per cent.	58·4	51·6	41·2	65·3
Other negative rods .. .. .. ,,	3·2	3·2	8·6	4·
Negative cocci .. .. .. ,,	7·9	11·8	9·8	11·9
Negative spirilla .. .. .. ,,	..	·09	·19	..
Positive bacilli .. .. .. ,,	13·	10·	14·7	·3
Positive bacilli with spores .. .. ,,	·12	..	..	·03
Positive cocci .. .. .. ,,	12·6	19·5	19·9	9·7
Oval free spores .. .. .. ,,	1·3	·5	1·4	·16
Spherical free spores .. .. .. ,,	·9	·6	·5	·06
Yeasts .. .. ,,	1·9	2·5	3·1	·03
Weight of 2·5 grams after drying to constant weight at 103° C.	·724	·625	·682	·515
Weight of 2·5 grams after fractional sedimentation (Strassburger)	·105	·087	·129	·100
Nature of specimen	Very dry	Moist	Moist seeds, fibres	Moist, many fibres

—	Maximum.	Minimum.	Average.
Colon type bacilli	65·3	41·2	54·1
Other negative bacilli	8·6	3·2	4·75
Negative cocci	11·9	7·9	10·3
Positive bacilli	14·7	8·3	11·5
Positive cocci	19·9	9·7	15·4
Oval free spores	1·4	·16	·84
Spherical free spores	·9	·06	·5
Yeasts	3·1	·03	1·88

From these it is seen that specimen number 4 contains the highest number of bacteria, and number 2 the lowest, but compared with MacNeal's lowest figures number 4 is small. The explanation of this discrepancy is either that fewer bacteria were taken in with the food, or that conditions in the bowel in this latitude in some way prevent the multiplication of those bacteria suited to the bowel environment, or that the bacteria are destroyed before being passed out with the fæces.

Partial desiccation of the contents of the rectum, as a result of continuous sweating is apparently not responsible, for if that were the case the dry bacteria per gram as ascertained by the Strassburger method and the dry substance per gram should show higher figures than those obtained by MacNeal. Instead of this, the dry bacteria per gram is on the average more than one-third lower, and the dry substance per gram practically the same.

On the other hand, the average of these four bacterial counts is much higher than the figures obtained by Klein. The bacterial counts being low, much beyond the extent to which the dry bacteria per gram figures are low, the ratio between the two, as expressed in the second column of the table, is as a result much lower than the figures of MacNeal. As these ratios show, in the fæces of number 4, five times as many bacteria are required to weigh 1 gram, as are required in subject number 2.

DIFFERENTIAL COUNTS.

In making the differential counts, at least 3,000 organisms were classified and enumerated.

The morphological classification of the bacteria was, as a rule, easily made, but where the classification depended on the colour, it was at times exceedingly difficult. This was more especially noticeable when micrococci were in question.

Gram negative bacilli, ·4 to ·9 microns wide, and 1 to 2·5 microns long, were classed as being in the Colon group, all the other gram-negative bacilli were placed in the second group.

Spirilla were found in two of the samples; in one they were present to a noticeable extent.

Slender, undulating spirals were found in only one of the specimens, and then but one was found.

Gram positive rods showed a maximum of 14·7 per cent., and a minimum of 8·3 per cent., with an average of 11·5 per cent. This average exceeds the average of any of the specimens examined by MacNeal, but the maximum is but little in excess of the maximum obtained by him (13 per cent.).

The gram positive cocci varied from 19·9 per cent. to 9·7 per cent., with an average of 15·4 per cent. The minimum is greater than MacNeal's minimum (·4), and the maximum is much less than his (31·6 per cent.), but the average exceeds his grand average (11·3).

Oval free spores varied from 1·4 to ·16, with an average of ·84, as compared with MacNeal's average of 1·46. Spherical spores varied from ·9 to ·06, with an average of ·5, compared with an average of ·86.

Yeasts which were apparently entirely absent from MacNeal's specimens were here found in one case with a percentage of 3·1, and the four examinations showed an average of 1·88. The presence of yeasts in the specimens examined here is no doubt accounted for by the comparatively large amount of fruit and uncooked vegetables, such as tomatoes, eaten by the ordinary man in Townsville.

CULTURAL EXPERIMENTS.

A very large amount of time was spent in the investigation of the flora from the cultural point of view, but the results obtained, though they suggested fresh avenues for investigation, differed in no way from those of other observers.

The figures showing the number of bacteria per gram of dry fæces being derived from the figures in column 1 are naturally low.

The percentage by weight of the bacteria in dry fæces varies from 14 to 19·4, and averages 16·7.

All of these figures are higher than those obtained by Lissauer and Klein, though lower than those of other observers, as Steele, Strassburger, and MacNeal.

The number of bacteria estimated by growth on an agar plate is included in the table, and the results go to show that there is no constant ratio between the number of bacteria still viable and those actually present in the fæces.

SUMMARY.

The results obtained by other observers vary to such an extent that it is not possible, with the means now at our disposal, to arrive at that stage when it can be truthfully said that standards have been established.

The fæcal flora is so dependent on the diet and the idiosyncrasy of different internal tracts that it is extremely doubtful if any but a rough agreement will be found in the mass of flora of different individuals.

To try to settle this doubt would entail such an enormous amount of work and offers such little prospect of a satisfactory conclusion that, for the present, I do not consider the results, if any, would justify the time spent.

TABLE II.

No.	Bacteria per gram by enumeration, Eberle-Klein method.	Ratio.	Dry bacteria per gram Strassburger.	Dry substance per gram.	Bacteria in dry fæces. Number per gram.	Per cent. by weight.	Bacteria per gram after 48 hours on agar at 37°C.
I.	65,906,176,000	16 by 10^{11}	·042	·289	228,000,000,000	14·5	85,500,000
II.	29,343,661,600	18 by 10^{11}	·035	·250	117,200,000,000	14·0	289,800,000
III.	71,749,164,900	14 by 10^{11}	·052	·273	262,400,000,000	19·0	153,100,000
IV.	172,871,670,800	43 by 10^{11}	·040	·206	838,500,000,000	19·4	57,960,000
Klein	58,800,000,000	..	..	..	..	13·0	..
MacNeal	723 by 10^9 (647) mean	54	·119	·307	2107 by 10^9	38·64	..
	149 by 10^9 (175) mean	28	·063	·159	1101 by 10^9	39·59	..
Steele	..	..	..	..	..	19·1 (average of 3)	..
Lissauer	..	..	..	..	..	2·53 to 13·54 8·67 (average)	..
Strassburger	..	..	..	..	..	30·0	..

REPORT OF ENTOMOLOGIST, 1ST JULY TO 15TH SEPTEMBER, 1918.

By F. H. Taylor.

I left Townsville, in company with Doctor Breinl, to assist in a malarial survey of the Innisfail District, returning a fortnight afterwards. Mosquitoes were by no means common in the district at the time of my visit, probably owing to the fact that it was the winter season.

Anopheles (*Nyssorhynchus*) *annulipes* (Walker) was found in small numbers in the swamps in and around Innisfail, mainly in the swamp behind the town. This swamp is shallow, of small extent, and heavily overgrown with scrub and palm trees.

The mosquitoes found, other than *Anopheles* (*Nyssorhynchus*) *annulipes* were *Culex concolor* (this species has previously been recorded as *C. tyripes* from Australia, *C. tyripes* does not, however, exist in Australia); *Stegomyia quasiornata ; Finlaya poicilia ; Pseudoskusea multiplex ; Mansonoides uniformis* and *Lophoceratomyia* sp. nov. (a crab hole dweller) in addition to the domestic mosquito *Culex fatigans* and *Stegomyia fasciata. Anopheles* (*Myzorhynchus*) *barbirostris* var. *bancrofti* appeared to be absent, as neither the larvæ nor adults could be found after diligent search.

Similar conditions to those in Innisfail prevailed at Mourilyan Township and Harbor, though the country is more heavily timbered and swampy. It is also sparsely settled and inaccessable. *Anopheles* (*Nyssorhynchus*) *annulipes* was found in small numbers throughout the swamps, which are very extensive. As at Innisfail, *A.* (*Myzorhynchus*) *barbirostris* var. *bancrofti* was not found.

Pseudoskusea multiplex was fairly common, though not abundant round the swamps and in the scrubs, whilst *Stegomyia fasciata* was relatively abundant at Mourilyan township.

Three papers on biting flies were completed and sent to press : one on sand flies, one on *Tabanidae* (March flies), and one on *Culcidae* (mosquitoes).

The one on sand flies contained notes on a previously known species and descriptions of three new species—two new species of culicoides, one received from Doctor Cumpston, Director of Quarantine, Melbourne, and one taken by my colleague, Doctor W. J. Young, in Townsville. The third species was a new *Simulium* received from Doctor T. L. Bancroft, who generously forwarded a fine series, both mounted and in spirit.

The second paper on *Tabanidae* contained notes on previously known forms with description of a remarkable new genus and 26 new species, mainly belonging to the genus *Tabanus*.

The third paper dealt with the *Culicidae*, and contained notes on a number of previously known species, with descriptions of several new species mainly from Cairns, North Queensland. Two species in particular, amongst the synonymy, are of interest—*Culex parvus*, Taylor, and *C. abdominalis*, Taylor—as they are shown to belong respectively to two oriental species.

These papers will be published shortly.

One paper, in conjunction with Doctor Breinl, was published during the half-year in the *Medical Journal of Australia*, on the results of the Malarial Survey in Cairns, undertaken in July, 1917.

I resigned from my position as Entomologist on the staff of the Institute as from 15th September, as I had been appointed Entomologist to the Special Blow-fly Committee, Queensland, of the Commonwealth Advisory Council of Science and Industry.

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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE,

TOWNSVILLE, QUEENSLAND.

YEARLY REPORT

FROM

1ST JANUARY TO 31ST DECEMBER, 1919.

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THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

YEARLY REPORT FROM 1st JANUARY, 1919, TO 31st DECEMBER, 1919.

I have the honour to submit a brief report on the work carried out in the Australian Institute of Tropical Medicine from 1st January to 31st December, 1919; a separate short report of each of the members of the staff is appended.

The staff consisted during the whole of the time of—

A. Breinl, Director.
W. J. Young, Biochemist.

Dr. J. J. Harris resigned his position as Bacteriologist to the Institute on 14th June, and left on 14th July.

Mr. G. Hill was appointed entomologist, and entered on his duties during the month of February.

A great deal of the time of Dr. J. J. Harris since new year was taken up by his duties as Quarantine Officer on account of the outbreak of influenza, and from about the middle of April the whole of his time was devoted to quarantine duties.

Dr. W. J. Young resigned his position during this year, and will leave Townsville at the beginning of January, 1920.

The work comprised, in the same way as previously, research work connected with tropical medicine and hygiene, research into the physiology of the inhabitants of North Queensland of European descent, and in addition the necessary clinical work in connexion with the Tropical Ward of the Townsville Hospital.

Field work had to be entirely neglected on account of the shortage of staff, the Director representing, during the greater part of the year, the only medical member of the staff available. For this reason it was impossible for him to be absent for any length of time from the Institute. A Committee meeting took place in November, 1919, in Melbourne, which was attended by the Director.

During January and part of February Dr. W. A. Osborne, Professor of Physiology of the Melbourne University, visited the Tropical Institute. During his stay, extending over January and part of February, he carried out some original research work, and made his physiological and climatological experience available to the members of the Institute. He offered valuable criticism on several questions, and made suggestions concerning the carrying out of further physiological work.

Many of his suggestions were embodied in a short report to the Minister for Home and Territories, which report, written after his return, has been submitted to the Committee.

I. Dr. Young and myself concluded our paper on "Tropical Australia and its Settlement." This publication, which appeared in the *Medical Journal of Australia*, contained a short comparative summary of the climatic conditions prevalent in the different townships of North Queensland, expressed in average dry and wet bulb temperatures, and in average maximum and minimum temperatures and rainfall extending over a period of five years.

It was shown that the climate of the coastal towns differs essentially from that of the inland towns, in as far as coastal towns offer lower dry bulb and higher wet bulb readings. In the coastal towns the average wet bulb readings increase with decreasing latitude, and at the same time the contrast between the dry and wet season becomes less pronounced.

The physiological effect of sunlight on the animal organism is discussed at length, and the effect of heat and humidity is fully and critically dealt with.

The changes in the physiology of the white man living under tropical conditions is dealt with, and the results of the work carried out at the Institute, as well as the general literature, are fully considered.

The conclusion was reached that, as far as our present knowledge goes, no definite qualitative physiological changes could be ascertained in the inhabitants of North Queensland, although in some respects definite quantitative changes were discovered.

The quantity of urine, for example, during the hot season is definitely decreased, which decrease may be accounted for by the loss of water from the body by the skin.

In consequence, the amount of sodium chloride excreted in the urine is considerably less, which decrease is again compensated by the loss of sodium chloride by the skin in the sweat. The body temperature at rest does not vary in the tropics from that in a temperate climate, although it was found that with exercise the body temperature rises more quickly and subsequently decreases more slowly than in a temperate climate.

A tropical anæmia due directly to climatic conditions could not be found, and with slight variations, such as increased eosinophilia and a change in the Arneth count, the blood conditions of North Queensland inhabitants did not vary from those considered normal for a temperate region.

Researches into the metabolism in the tropics are fully discussed, and it is pointed out that the total quantity of nitrogen in the urine of Northern Australian inhabitants is decidedly below the average European standard, and that there is an indication of a decrease in the amount of protein metabolised.

It is pointed out that a closer and detailed study of the functions of the nervous system might be of interest and value, and might reveal definite alterations. Up to the present most of the statements regarding tropical neurasthenia are only founded on personal opinions, and no definite statements based on facts regarding " Tropical Neurasthenia " amongst North Queensland inhabitants can be made.

The paper contains a discussion on housing, clothing, and general conditions prevalent in North Queensland.

II. The experiments on the effect of exercise and humid heat upon pulse rate, blood pressure, body temperature, and the blood concentration have again been continued during the hot months of the year, and the results obtained up to now have been embodied in a publication by W. J. Young, A. Breinl, J. J. Harris, and W. A. Osborne, which is accompanied by eight elaborate tables, and is in the press at present. Part of the work has already been referred to in the report for the second half of 1918.

Professor W. A. Osborne, during his stay, joined in the continuation of these researches. and he suggested the use of the refractometer for the estimation of the protein concentration of the blood serum under varying conditions, in order to ascertain whether profuse sweating led to a concentration of the blood serum. In addition, he introduced his method for the estimation of the total solid content of the blood under similar conditions. Our previous experiments, utilizing specific gravity methods, were not sufficiently delicate to obtain conclusive evidence on the blood concentration. Experiments as suggested by Professor Osborne were carried out and embodied in the publication.

The summary is as follows :—

1. Vigorous exercise of short duration caused—
    - (*a*) An increase in the pulse rate and blood pressure, both of which rapidly fell to normal after discontinuation of the exercise.
    - (*b*) An increase in the carbondioxide percentage of the alveolar air.
2. The alveolar air at rest in inhabitants of tropical Queensland showed a lower carbondioxide content than the European average.
3. Prolonged exercise leads to a rapid increase in the pulse rate and temperature at first, which increase becomes more gradual afterwards, and in the case of blood pressure even fell on occasions below normal on account of the profuse sweating. Prolonged exercise had but little effect on the alveolar air.

    The body temperature during the exercise continued to rise slowly, but, considering the light nature of the exercise, the rise in temperature was considerable.
4. A considerable loss of water from the body was observed as the result of prolonged exercise. Blood estimations showed that this water was mainly derived from other sources in the organism than the blood plasma ; a small concentration of the blood plasma, however, had taken place.
5. The hot room experiments gave results similar to those caused by prolonged exercise, with this difference, that the pulse rate and body temperature rose more gradually at first, but a quicker rise took place afterwards.
6. The results point to the fact that both exercise and humid heat play a part in producing a rise in blood pressure, pulse rate, and rectal temperature. The degree of the rise, however, is controlled by atmospheric conditions, which influence the rate of cooling of the body.

III.—STATISTICAL INQUIRY.

During the second half of the year I carried out a statistical inquiry into the disease incidence in North Queensland, into birth rate and infantile mortality. The figures available in the statistical reports refer only to Queensland as a whole or to registration districts, and it is impossible from their consideration to draw definite conclusions as to the birth rate and infantile mortality of North Queensland without taking out the figures for definite districts. Data as to the admissions to and the death in the hospitals were only available for the individual hospitals and not for districts.

In order to obtain definite statistical data for districts in North Queensland for comparison with other parts of Queensland, it was necessary to divide the whole of Queensland into districts, and take out the statistical figures for these districts. It was found that the whole of Queensland had been previously divided for the purpose of census into thirteen districts, which could with advantage be utilized for this inquiry.

Out of the thirteen districts, seven are coastal districts and five are inland districts. Three of the former are situated in South Queensland, one in Central Queensland, and three in North Queensland; of the inland districts, three are situated in South Queensland, one in Central Queensland, and two in North Queensland.

Hospital statistics when taken over a number of years form a valuable guide to the health condition of the various districts. The figures obtained for the larger base hospitals are, however, not a conclusive guide for the districts in which they are situated, as many of the base hospitals, and to a much greater extent the metropolitan hospitals, draw their patients from a much larger area than the actual districts; but this source of error, as far as Queensland is concerned, is in all probability practically the same for every larger base hospital.

The hospital statistics were taken out according to groups of diseases.

Class 1 (General Diseases) was subdivided into eleven subdivisions, namely, typhoid fever, influenza, dengue, dysentery, tuberculosis, syphilis, tetanus, cancer, rheumatism, alcoholism, and all other general diseases.

The other classes, with the exception of Class 3, were left undivided, as the figures available for several of the smaller districts would have been too small, and would have influenced the averages so greatly that the results would have been erroneous.

Class 2 comprises the diseases of the nervous system.
Class 3, Group 1, comprises endocarditis, organic diseases of the heart, and angina pectoris; and Group 2 the diseases of blood and lymph vessels.
Class 4, the disease of the respiratory system.
Class 5, of the digestive system.
Class 6, of the genito-urinary system and adnexa.
Class 7, puerperal conditions.
Class 8, disease of the skin and cellular tissue.
Class 9, disease of the organs of locomotion.
Class 10, malformations.
Class 11, infancy.
Class 12, old age.
Class 13, violence, and
Class 14, ill-defined diseases.

The number of deaths in the hospitals was taken out for the same districts, and from the number of admissions and the deaths the case mortality rate was calculated.

The following hospitals are situated in the districts :—

District 1.—Brisbane General Hospital, Children's, Diamantina, Lady Lamington, and Mater Misercordiae.
District 2.—Beaudesert, Boonah, Ipswich, Laidley, and Kilcoy.
District 3.—Bundaberg, Eidsvold, Childers, Gayndah, Gin Gin, Gympie, Kingaroy, Maryborough, Mt. Perry, Nanango, and Wondai.
District 4.—Gladstone, Many Peaks, Mount Morgan, Rockhampton, General, and Children.
District 5.—Bowen, Ayr, Charters Towers, Mackay, Proserpine, Townsville.
District 6.—Chillagoe, Forsayth, Atherton, Innisfail, Ingham, Herberton, Irvinebank, Mareeba, Mt. Garnet, Mt. Molloy, Mt. Carbine, Stannary Hills, Wolfram Camp, and Cairns.
District 7.—Cooktown, Port Douglas, and Thursday Island.
District 8.—Burketown, Camooweal, Cloncurry, Einasleigh, Croydon, Georgetown, Normanton, Hughenden, Kuridala, Richmond, and Selwyn.
District 9.—Boulia, Kynuna, and Winton.
District 10.—Adavale, Augathella, Charleville, Cunnamulla, Thargomindah.
District 11.—Aramac, Barcaldine, Blackall, Clermont, Emerald, Jundah, Longreach, Isisford, Muttaburra, Springsure, and Tambo.
District 12.—Mitchell, Mungindi, St. George, Taroom, and Roma.
District 13.—Dalby and Sanatorium, Goondiwindi, Miles, Stanthorpe, Surat, Texas, Toowoomba, and Warwick.

Figures were taken out for the years 1907–1916 inclusive, and the averages are therefore based on ten years of hospital returns, and calculated for 1,000 of population.

The number of deaths for the same groups of diseases as for the hospital admissions were obtained for the whole district, and the death rate was calculated for 1,000 of population.

The average birth rate was calculated for the same thirteen census districts, and in addition, as far as possible, the infantile mortality was determined. This could, however, only be accomplished for the years 1909 to 1916, as the vital statistics previous to 1909 only contain the mortality of children and infants of two years of age and less, and in general, infantile mortality only takes into consideration the death of children under one year of age in relation to the birth rate.

Table 1 contains the average admission rate of patients to the hospitals for the years 1907 to 1916 inclusive, calculated to 1,000 of population ; furthermore, the average case mortality per cent. for the same districts, and, in addition, the average death rates for the same districts, according to the disease groups.

In order to visualize the results, the average hospital admission rates were plotted in Chart 1 according to the geographical position of the district, districts 1 to 7 being coastal districts, and the districts 8 to 13 being inland districts, 1 and 13 are the southern districts, whereas 7 and 8 are the far northern districts.

It was only in respect to the rate of admissions to the hospitals for the various diseases that a definite change progressive with the latitude could be ascertained, whereas in respect to case mortality only irregular variations took place. The total death rates tabulated in Chart 2, however, show a similar tendency to rise with decreasing latitude.

The averages for the seventh census district, which includes Port Douglas, Cooktown, and Thursday Island hospitals, are inconclusive, as amongst the admissions to the Thursday Island Hospital the coloured hospital population has been included, whereas the district population figure includes only the white inhabitants.

For the years 1907–1916 inclusive the birth rates have been worked out for the same thirteen districts, and are contained in Table 2 and plotted on Chart 3.

In addition the infantile mortality was determined. Previous to 1909, in the Queensland Vital Statistics, the infantile mortality is only given for children of two years and under, and only from the year 1909 figures for the death of children of one year and less are recorded. It was therefore only possible to determine the infantile mortality for seven years. (Compare Table 3 and Chart 4.) Table 4 contains the estimated population of the thirteen census districts for the years 1907–1916.

Work on the same line will be continued in the future, and extended to a greater number of years.

IV. Previous work by Dr. Priestley and myself on the " Arneth Index " of the blood of healthy North Queensland children, of aboriginal children in the Northern Territory and in New Guinea, the former apparently healthy, the latter living in endemic malarial areas, has given interesting results. The " Arneth Index " is based on the nuclear conditions of the polymorphonuclear neutrophile leucocytes, and indicates the relative proportion of leucocytes of various age in the peripheral circulation. We were able to show that in the blood of North Queensland children the number of leucocytes of young developmental stages prevailed to a greater extent than in Europeans, and a still greater proportion of these young forms could be discovered in the blood of New Guinea children. The significance of the proportion of young leucocytes is still uncertain, although most observers accept the hypothesis that this is due to an increased activity in the functions of the bone marrow ; but the actual meaning of this preponderance of young leucocytes, whether due to a special lability of the blood-forming organs or to any other cause is unknown.

It was thought that the Arneth blood picture of children between the ages of six and fifteen known to be infected with hookworm, might throw further light on the " Arneth Index."

During the hookworm inquiry in Innisfail, and whenever opportunity offered in Townsville, blood films were taken from infected children and an Arneth and differential count was performed.

Up to the present 78 counts have been done, and the results are tabulated in the following table (Table 5) and compared with the previous results.

The results of this inquiry are interesting. When comparing the figures, it becomes clear that the Arneth count of the North Queensland hookworm-infected children differs greatly from that of normal Queensland children, and is nearly identical with that of New Guinea native children living in areas where malaria is endemic. The differential count is similar to that of normal North Queensland children with the exception of the percentages of eosinophiles, which is slightly higher ; but on the average not sufficiently raised to utilize it as a means of diagnosis of hookworm disease as in other parts of the world, where the percentages of eosinophiles under normal conditions is

The results obtained up to now in this inquiry justify the continuation of the work; it is only possible by estimating the " Arneth Index " under different conditions of health and disease to gauge its significance.

V. During the year I continue my investigations into the transmission of *filariasis*. In my previous work I have been able to prove conclusively that in the case of dog filariæ (*Filaria immitis*), the filarial larvæ taken up with the blood by the dog flea undergo in the flea the complete development up to these stages, which form the mature larvæ ready to infect the new host; these large forms, which are actively motile, were found free in the body cavity of the fleas, whereas the earlier developmental stages were encountered inside the malpighian bodies only. The continuation of this work was made impossible by the onset of the cool weather, when the development of the filarial larvæ became much slower and did not lead to the formation of the largest actively motile forms, but sufficient material for a morphological study had been obtained.

For comparison, a similar study was undertaken using mosquitoes (*Stegomyia fasciata*) as intermediary host. In the mosquito the developing parasites were studied morphologically, and agreed in every respect with those found in the dog flea, thus furnishing the undoubted proof that the nematode larvæ found in the dog flea were indeed developing filarial larvæ.

Also, in the infected mosquitoes, the onset of the cool season interfered greatly with the development of the parasites in the intermediary host, and even after a period of 14–17 days after feeding, when during our hot season the complete metamorphosis had taken place, during the cool season only the earliest (short and stumpy) developmental forms were seen in the Malpighian tubes.

It seemed of interest to ascertain the behaviour of the largest active motile forms when brought in contact with the shaved skin of puppies.

Mosquitoes were infected, and after 14–16 days the insects crushed on the shaved bare skin of a dog, and after the lapse of a few minutes the piece of skin was removed with a sharp pair of scissors, fixed, and cut into serial sections. In one case only out of seven could it be noticed in a few sections that the large, mature filarial larvæ had penetrated with the head into the subcutaneous tissue, and was embedded between the fibres of connective tissue.

This work will still be continued, and will probably yield additional evidence, showing that mature filarial larvæ may penetrate through the unbroken skin and thus cause infection.

VI. I carried out at intervals some work on the effect of injections of foreign proteins on the liberation of antibodies. Within the last few years much has been published on the curative effect of injections of peptone and other foreign proteins in typhoid fever, rheumatism, &c., and according to several authors the results were more than encouraging. In a paper published in the *Journal of Infectious Diseases* (1918) Herrman came to the conclusion that intravenous injection of foreign protein serves as stimulus for the liberation of antibodies in animals in which the previously injected antigen is unable to cause such liberation. Experiments were carried out on a number of rabbits which were previously injected with sheep-blood corpuscles. The hæmolytic titre of the serum of these animals was ascertained, and at varying intervals varying quantities of pepton solution injected intravenously. Twelve rabbits were used, and the experimental conditions varied, but in no instance did the injection of peptone have any effect upon the hæmolytic titre of the serum when compared with the control animals.

During the past two years Mr. J. W. Fielding, the Senior Laboratory Assistant, carried out observations on the bionomics of mosquitoes in Townsville, selecting *Stegomyia fasciata* (the mosquito which transmits yellow fever) for the work. The results of his observation are embodied in a publication which has been sent to the Annals of Tropical Medicine and Parasitology. A great deal of the time of Mr. G. Hill, during the first few weeks after his arrival in Townsville, was spent in helping in the preparation of this paper for the press.

Up to the present no research of any importance has been carried out in North Queensland on this species of mosquito.

Fielding has shown that *Stegomyia fasciata* breeds all the year around in Townsville, although differences were noted in their habits during the hot and cool months. During the former months the eggs hatched more quickly and developed more speedily.

Stegomyia, according to Fielding's experience, does not appear to show any preference for certain rooms or situations, but will oviposit in any receptacle containing water.

Undiluted sea water did not seem to attract the female mosquito for oviposition, although eggs were laid in 70 per cent. sea water.

The experiments on the influence of periods of drying upon the hatching of eggs are interesting. " Dried Eggs " retained their vitality for 257 days, and even after a period of drying extending over 216 days still 52·4 per cent. of all the eggs hatched. " After long periods of drying 32 batches of eggs, numbering from 30 to 1,000, were stored for periods varying from 391 days to 579 days, and then subjected to stimuli to induce hatching. In all the experiments negative results were obtained."

Elaborate experiments on the effect of food and temperature upon the larvæ were carried out and tabulated.

Experiments were carried out on the stimulating effect of weak lysol solution and of soap solution upon the hatching of resistant eggs.

Adults were kept in captivity for a maximum of 93 days, and careful records were kept of the eggs laid, their habits carefully observed, and many observations recorded as to the relation of food—blood and otherwise—on the egg-laying habits.

The following cases were treated in the Tropical Ward of the Townsville Hospital during the year 1919:—

	Males.	Females.	
Typhoid fever	12	8	
Febricula	7	3	
Endemic glandular fever	3	..	
Malaria	23	1	
Anæmia	2	1	
Agchylostomiasis	41	61	(161 re-admissions)
Tapeworm	1	..	
Hymenolepis nana	5	4	
Sprue	6	7	
Enteritis	..	3	
Beri-beri	2	..	
Filaria	3	1	
Elephantiasis	1	1	
Ulcerative granuloma	2	7	
Lead poison	2	..	
Snake-bite	2	..	
Total	112	97	

LIBRARY FUND.

The Library Fund, composed of the money received for consultations and pathological examinations, which amounted to £339 12s. 5d. at the end of 1918, was increased during the current year by £137 16s. 2d. The expenditure on books during the year amounted to £105 19s. 4d., so that there is a credit balance to the Library Fund of £371 9s. 3d.

REPORT OF THE BIOCHEMICAL LABORATORY FOR THE YEAR 1919.

By W. J. Young.

1. During Professor Osborne's visit to Townsville, experiments were begun in conjunction with him on the chemical and physical properties of the sweat. Sweat was collected from several individuals in an artificially-heated chamber, in which the atmosphere was almost saturated with moisture, so as to avoid as far as possible any concentration of the sweat by evaporation. The properties studied were the vapour pressure, surface tension, and osmotic pressure (freezing point), total solid matter, the sodium chloride content, and the calcium and solid content. A paper on the results is now in course of preparation.

2. In the cooler weather further experiments were carried out on the metabolism at rest (basal metabolism) by measuring the respiratory exchange. The same two subjects previously employed were again examined. It was found that in general, with both subjects, the metabolism was lower than in the hot season, which was more evident in the experiments carried out indoors, where external conditions did not show any great variation from day to day over fairly long periods in either season. Experiments done outdoors showed, on the whole, a similar result, but were complicated by the fact that on several occasions in the cooler weather the rate of cooling was sufficiently great to reduce the body temperature and to cause a feeling of cold, often even shivering, and this caused an increase in metabolism.

It has been shown by Benedict and his co-workers that the metabolism at any time is determined not only by the conditions which obtain at the time of the actual measurement, but also by conditions (such as exercise) which have gone before. Such conditions may influence the cellular activity long after all external evidences have disappeared, causing an increase in metabolism. The higher metabolism observed in the hot season is to be attributed to the effects of such earlier conditions, which have a larger influence and persist longer than in the cool weather. The exercise taken in the ordinary daily routine produces in the hot weather a greater rise of temperature and a correspondingly greater rate of metabolism than in the cool weather, and further, these effects would wear off more slowly in the hot moist atmosphere, so that the resting period prior to the measurement of the respiratory exchange would produce a greater modification of the metabolism in the cool weather. A paper on these experiments is now in the press.

3. Samples of the black pigment (melanin) from the skin of two Australian blackfellows and a Cingalee were purified and submitted to ultimate analysis.

The pigments were obtained by repeated extraction with hot dilute sodium hydroxide (0·2 per cent.).

In every case the first few extractions yielded compounds which were soluble in very dilute hydrochloric acid or acetic acid; but from the later fractions the product obtained was insoluble in dilute acids.

The acid-soluble fractions contained more nitrogen and hydrogen than the later insoluble fractions, which would suggest that the continued treatment, even with so dilute a solution of alkali, caused a loss of hydrogen and nitrogen.

In all these cases the acid soluble pigment varied slightly in its composition, showing that either it was not pure or else had been modified by the extraction with alkali from that originally present in the skin.

This work is now ready for publication.

4. Some further work on the progressive action of trypsin was done, but was discontinued owing to the improbability of being able to finish it before my departure from Townsville.

5. Recent statements have been made by De Hangen and Schut, working in Java, that the sugar in the blood of white men living in the tropics is at a higher level than that found in temperate climates, and these workers have concluded that this is entirely to be attributed to the higher atmospheric temperature. They conclude also that "Diabetics and persons with a turn for renal glycosuria should be absolutely dissuaded from settling in the tropics." Their observations are based, however, on a very small number of persons (nine).

In view of this it was thought desirable to commence a research into the composition of the blood in North Queensland. This work has been begun, but so far only a limited number of persons have been examined. The method employed at first was the colorimetric method of Lewis and Benedict as modified in a later paper by Benedict. The blood was drawn from the vein. Within the last few months doubt has been thrown on this method owing to the presence in blood of substances giving with the picric acid employed a similar colour to that given by sugar, so that all determinations of sugar in blood tend to be too high by this method. Recourse was had to a recent method of Maclean which permits of the determination of sugar in 0·2 c.c. of blood, a quantity easily obtained by pricking the finger.

The blood, taken about 12 noon in every case, of nine persons examined by the colorimetric method gave the following results, the quantities found will be rather higher than the true quantity:—

No.	Solids per cent.	Blood Sugar grms. per 100 c.c.
1	19·8	0·101
2	20·3	0·117
3	20·4	0·126
4	21·2	0·099
5	22·4	0·108
6	22·1	0·126
7	19·9	0·097
8	19·8	0·113
9	19·8	0·117

Gettler and Baker, in America, found by the same method, with 32 subjects, figures from 0·05 to 0·12.

By Maclean's method eleven persons were examined. It was found, however, that very considerable variations were obtained in the blood sugar of the same subject, according to the time which had elapsed since the last meal. The effect of food was to increase the blood sugar. In one subject the blood sugar was estimated periodically during the day, and the quantities are given in Table 2. Lunch was taken between 1 and 2 and tea between 4 and 5, followed in each case by an immediate rise in the sugar.

TABLE 2.

Time.	Sugar per cent.
11 a.m.	0·099
12 noon	0·102
1 p.m.	0·103
2 p.m.	0·156
3 p.m.	0·121
4 p.m.	0·110
5 p.m.	0·126

The sugar in the blood of eleven persons taken about noon several hours after a meal varied from 0·088 to 0·119 per 100 c.c., with an average of 0·102 grms.

In view of these variations and of the small number of observations no conclusion is possible, but on account of my departure it was thought advisable to put the figures on record.

6. An investigation was commenced into the chemistry of the digestion in sprue. The presence of large quantities of fatty matter in the stools of sprue patients suggested to Dr. Breinl and myself that the pancreatic secretions were at fault, and, as a preliminary, the quantity of acid in the stomach contents of sprue patients was determined. The stomach contents were obtained after a test meal of the tea and toast, and the acidity determined in the usual way. In all the gastric secretions of nine cases of sprue were tested. In every case the stomach contents contained only very small quantities of acid, in some they were almost neutral, and hydrochloric acid both free and combined was almost entirely absent, or present in abnormally small quantities. It is hoped to continue this work.

7. A few analysis of pathological material were made.

REPORT OF THE ENTOMOLOGIST FROM 25TH FEBRUARY TO 31ST DECEMBER, 1919.

By G. Hill.

I was appointed in January, 1919, as Entomologist in succession to Mr. Frank H. Taylor, F.E.S., who severed his connexion with the Institute in November, 1918, to take up research work in connexion with the Blow Fly Pest under the direction of a Sub-Committee of the Institute of Science and Industry.

Upon my arrival in Townsville, on 25th February, it was found necessary to devote some time to the care of the fine collection of blood-sucking flies compiled by my predecessor during his association with the Institute.

During the four months which elapsed between Mr. Taylor's departure from and my arrival at Townsville, the mosquito section of the collection suffered some injury owing to the depredations of book-lice (*Psocidæ*), and I regret having to report that certain type specimens were irreparably damaged. As a whole, the collection is in excellent condition, and, although by no means complete, it is probably the finest collection of Australian blood-sucking flies in the Commonwealth, and one which reflects the greatest credit upon its compiler.

A paper on Australian Stratiomyidæ (*Diptera*), commenced in Melbourne prior to my appointment, was completed here in March, and has since been published.

Included in the field work undertaken by me during the period covered by this Report were fairly frequent visits to neighbouring localities for the purpose of collecting blood-sucking flies and familiarizing myself with their breeding places and habits. The season proved to be an unfavorable one, owing to unusually light late rains and consequent early drying up of swamps and water-holes.

MARCH FLIES AND SAND FLIES.

March flies (*Tabanidæ*) and sand flies (*Simulidæ* and *Chironomidæ*) were very rarely seen in March, and were not met with again until December, when a few of the former made their appearance.

It was hoped that sufficient material for the commencement of a study of the life histories of some local species of *Tabanidæ* could have been obtained before the surface waters dried up, but, owing to the scarcity of adult flies, egg clusters were extremely rare, and only one viable mass was secured for breeding out. Attention was directed then to the larvæ, with the result that three species were secured in the banks of water-holes or amongst aquatic plants. Of these, two have since been reared to the adult stage, whilst the third have not yet completed their life cycle. It is satisfactory to note that the hitherto unknown male of a common North Australian species and the hitherto unknown female of an unique form from Townsville have thus been added to the collection. It may be mentioned that the *Tabanidæ* or march flies are represented in Australia by a large number of species, many of which are exceedingly numerous after the early summer rains. Notwithstanding these facts, there is no published account of the life history of any Australian species. Although not known to play any part in the transmission of disease in man or stock in Australia, the females of most, if not all, species of *Tabanidæ* are voracious blood-suckers, and as such it is considered important that their bionomics should be studied.

MOSQUITOES.

The first visits to the swamps in the vicinity of the town common were paid early in March, when the water was at a low level and rapidly drying back. In the shallowest water, near the margins and especially in hoof-holes, the larvæ of *Culicelsa consimilis* were then very numerous indeed, and associated with them were considerable numbers of *Nyssorhynchus annulipes.* The water was foul-smelling, and covered with an irridescent film, and often contained masses of algal growth. The deeper and clearer water further from the margins appeared to be free of mosquito larvæ, probably due to the presence of numerous predaceous insects. The *Culicelsa* larvæ reached their maximum density between 27th March and 5th May, decreasing in numbers noticeably about 16th May, and finally disappearing for the season about 10th June. *Nyssorhynchus* larvæ were most numerous between 27th March and 19th April, falling off in numbers until 5th May, when few were to be found in these swamps.

Large batches of larvæ were secured at each visit, and were bred out for determination and experimental purposes. In addition to the two species referred to, a single specimen of *Culex bitæniorhynchus* was found in one batch of larvæ.

A small permanent running spring, distant about one-half mile from the Institute, was examined by me for the first time at the end of July, when it was found to contain numerous young *Nyssorhynchus* larvæ. Visits were paid at frequent intervals during the following months at about sunrise and sunset to ascertain if the adults were biting, and, during the day, to search for larvæ. These visits demonstrated the presence of numerous small larvæ and a few full-grown larvæ and pupæ throughout the winter. No adults were seen until 24th December. During the period August to 24th December the proportion of full-grown larvæ and pupæ to young larvæ appeared to be very low, possibly due to the activity of notonectids and other mosquito-larvæ predators; but there was a marked increase late in December, when all forms of life had increased correspondingly. The larvæ of *Culicelsa consimilis* were also found throughout the year in this spring, in which they were the predominant species from about 19th October to late in December. At the present time *Nyssorhynchus* appear to predominate.

From April to December attempts were made to breed *Nyssorhynchus annulipes* in captivity. The experiments were made in the ordinary mosquito cages, measuring 7 x 8 x 12 inches, and in larger cages measuring 16 x 16 x 17 inches, with mosquitoes resulting from full-grown larvæ or pupæ obtained from one or other of the localities referred to above. In all instances the females refused to feed, and gradually died out without copulating. In June two batches, each of twelve females, were liberated in the writer's bed-net after repeated failure to induce them to feed upon the arm in the smaller cages, the results, however, were the same as in the other experiments. It is proposed to continue experimental work on these lines during the summer months before the attempt to breed *Nyssorhynchus* in small cages is abandoned. Certain observed habits in the males suggest the probability that only large enclosures, in which natural conditions are simulated as far as possible, will give satisfactory results.

The discovery of what is almost certainly a new species of *Stegomyia* emphasizes the importance of continuing and extending the mosquito survey of North Queensland commenced by my predecessor. The mosquitoes in question were bred from larvæ collected by Dr. Elkington, in October, at Pallarenda Quarantine Station. Associated with the *Stegomyia* larvæ were about an equal number of larvæ of the common and widely distributed mosquito *Scutomyia notoscripta.* Attempts to breed from a small stock of the former species proved unsuccessful. Although both sexes fed very readily in captivity, the males succumbed in three or four days and the female in from eight to ten days. In view of the possible importance attached to the discovery of a species of *Stegomyia* under such circumstances, it is important to study the habits of this insect further as soon as material is available.

TERMITES OR WHITE ANTS.

During the latter part of the dry season, when conditions were unfavorable for the study of blood-sucking flies, attention was directed to an investigation of the life histories and habits of termites in the belief that the results will prove of great economic value in devising means of combating this serious pest. Already a considerable amount of data has been gathered which, when supplemented by future observations, will provide material for a publication on a group of insects which has hitherto been studied by few Australian investigators.

REPORT FOR THE YEAR JANUARY TO JULY.

By J. J. Harris.

I regret that during the last half-year my duties as Quarantine Officer interfered to a great extent with my work at the Institute; approximately a third of my time has been taken up in doing quarantine work.

During the Hookworm campaign last year it was noticed that the children in the Townsville Orphanage were infested by the dwarf tapeworm (*Hymenolepis nana*) to a much greater extent than any other section of the population.

This convenient " nest " suggested the possibility of working out the full life history of the parasite.

Reference to the available literature showed that the knowledge of the anatomy was apparently derived from some one original description, so it was decided that a description of the worm as found here should be first done.

Specimens were therefore obtained and preparations made; in this work considerable difficulty was experienced in finding a suitable stain, as staining the segments *in toto* was found to yield but a limited and unsatisfactory amount of detail.

The information obtained suggested that in all probability the original description was in some respects incorrect, or possibly the parasite found here is not the one originally described as *Hymenolepis nana.*

To decide the matter, segments were embedded in paraffin and sections cut, but on account of the high air temperature prevailing at the time the sections were not satisfactory, and the work had to be postponed till the winter.

Before this happened, however, quarantine duties became so pressing that up to the present the work has not been resumed.

During the investigation of fæcal bacteria last year, the question of the influence of diet on the intestinal flora suggested the advisability of endeavouring to ascertain if the addition of known substances to ordinary media could be shown to modify the virulence or toxicity of some well-known species of intestinal bacterium.

The practical powerlessness of all drugs to favorably influence the course of typhoid fever suggested the possibility that if it were found that any " sugar " or other compound deprived the typhoid bacillus of any of its toxicity it might be of value in the treatment of the disease.

With this object in view, the typhoid bacillus was grown for a fixed time on ordinary agar (plus 7 Eyre's scale), to which had been added 1 per cent. of glucose maltose, &c.

The resulting growth was emulsified in saline solution and standardized to a known strength, after which known quantities were injected intraperitoneally into white rats at weekly intervals. Four doses, each one twice the quantity of the preceding one, were given to each rat, and ten days after the last dose the rats were bled and the serum separated overnight. Next day the serum was tested for its agglutination titre and its power to fix complement.

Until the work was interrupted by quarantine duties, three sugars were tested in this way, and the results went to show that both the agglutination titre and the complement fixing power of the serum of the rat injected with the bacillus derived from the sugar medium were increased when compared with the control serum of the rat injected with the bacillus grown on ordinary agar. This increase, though not great, was marked in all cases, and a more extended series of observations would in all probability lead to results which would be of interest, and of some value. During the half-year a small amount of routine work (sputa examinations, blood work, and vaccine preparations, &c.) was performed.

TABLE 1.

—		Class I.—General Diseases.											Class II.	Class III.		Class IV.	Class V.	Class VI.	Class VII.	Class VIII.	Class IX.	Class X.	Class XI.	Class XII.	Class XIII.	Class XIV			
	District.	Typhoid Fever.	Influenza.	Dengue.	Cholera, Dysentery.	Tetanus.	Tuberculosis (all kinds).	Syphilitic Disease.	Cancer (all kinds).	Rheumatism (all kinds).	Alcoholism.	All other General Diseases.	Diseases of the Nervous Systems and Organs of Special Sense.	Pericarditis, Endocarditis, Heart Disease (Organic), Angina Pectoris.	Diseases of Vascular and Lymphatic System.	Diseases of the Respiratory System.	Diseases of the Digestive System.	Diseases of the Genito Urinary System and Adnexa.	Puerperal Condition.	Diseases of Skin and Cellular Tissue.	Diseases of Organs of Locomotion.	Malformations.	Infancy.	Old Age.	Violence.	Ill-defined Diseases.	Total Admission Rate from all Causes.	Popula-tion in—	District.
																												1907.	
Average Hospital admission rate for ten years per 1,000 population (Tetanus for six years only)	I.	1·456	·739	·357	·044	·005	1·513	·852	1·067	1·057	1·357	4·406	4·771	·907	1·364	5·356	6·622	4·287	1·412	2·315	·930	·160	·061	·326	4·495	1·059	47·04	144,416	I.
	II.	1·012	·568	·380	·040	·004	·085	·046	·240	·815	·324	1·276	1·138	·457	·290	1·906	2·268	1·391	·336	1·524	·260	·023	·009	·112	3·939	·199	18·70	61,885	II.
	III.	1·583	1·418	·360	·075	·006	·440	·133	·518	1·190	·447	1·564	1·950	·531	·957	2·854	4·074	2·250	·440	2·404	·805	·020	·018	·219	4·974	·227	29·00	67,262	III.
	IV.	1·097	·972	·851	·130	·007	·923	·288	·688	1·860	1·181	3·827	3·118	·832	1·116	5·583	7·895	3·912	·893	3·349	·810	·084	·099	·813	7·882	·834	49·81	44,416	IV.
	V.	2·200	·893	2·155	·211	·007	1·124	·963	1·177	2·180	1·554	4·319	3·895	1·004	1·247	5·051	7·424	5·211	·957	3·825	1·253	·055	·130	·940	6·628	·551	55·456	60,342	V.
	VI.	2·248	2·793	5·725	·696	·003	1·694	1·556	1·424	3·889	2·499	10·432	5·305	2·020	2·214	7·366	9·871	6·888	2·251	5·860	1·448	·098	·260	1·043	15·021	1·133	94·877	25,648	VI.
	VII.	·522	1·903	8·388	6·272	·009	1·504	2·991	1·086	3·885	1·751	53·090	5·698	1·595	1·617	7·633	11·171	5·873	1·386	8·276	2·543	·187	·138	·908	12·350	3·776	146·108	6,213	VII.
	VIII.	6·284	1·590	4·689	·595	·003	1·565	1·030	·754	3·630	3·175	8·442	5·555	1·125	1·279	7·026	7·961	4·893	1·668	4·019	1·209	·127	·071	1·816	13·910	1·335	83·859	13,080	VIII.
	IX.	6·704	1·746	3·140	·511	·004	1·399	1·065	·861	2·176	3·233	3·051	6·056	1·316	1·416	4·576	6·142	3·771	1·230	3·376	1·397	·019	·100	·243	6·875	·746	60·845	3,481	IX.
	X.	3·328	1·387	1·405	·365	·002	·689	·417	·292	2·323	1·963	2·754	4·284	1·098	·844	3·703	4·671	2·045	·667	3·184	·900	·041	·031	1·127	6·772	·640	43·550	8,617	X.
	XI.	3·641	3·666	3·637	·267	·002	1·462	·721	1·058	3·430	4·230	3·414	6·787	1·365	2·254	5·891	8·979	5·121	1·645	5·780	2·052	·035	·141	1·783	13·196	·924	83·469	21,029	XI.
	XII.	1·865	1·686	·556	·325	·002	1·222	·653	·858	1·594	·889	2·559	4·644	1·087	1·267	4·782	4·361	3·671	1·017	2·269	·760	·086	·166	·815	5·457	·568	43·006	12,561	XII.
	XIII.	1·453	·739	·190	·052	·001	1·891	·201	·504	·932	·410	2·431	2·087	·540	·669	3·265	4·074	2·319	·448	1·873	·633	·082	·041	·231	3·741	·340	29·286	69,959	XIII.
																											Total Case Mortality.	1911.	
Average Case Mortality for ten years per cent. according to districts	I.	5·80	·60	·48	·97	59·6	27·3	3·5	31·1	3·04	3·49	5·26	7·11	22·59	6·94	7·25	9·70	8·83	7·68	1·55	2·11	7·25	36·5	49·2	4·78	2·29	8·078	162,773	I.
	II.	8·61	1·81	·340	10·59	54·55	39·05	..	24·81	·84	2·86	4·78	8·64	20·6	7·04	7·02	5·03	5·95	4·74	1·67	3·19	..	3·75	15·66	3·48	·97	5·556	71,265	II.
	III.	6·63	·84	·72	17·34	44·4	26·50	3·96	35·36	·985	6·101	6·483	8·55	20·54	14·44	9·52	6·98	7·89	5·04	·82	1·64	..	20·0	22·03	3·23	4·59	6·83	75,253	III.
	IV.	6·80	·630	·224	14·52	57·15	19·48	2·78	29·07	·65	4·09	3·82	7·02	22·68	12·95	6·45	3·83	7·39	1·83	·54	·501	2·38	15·69	23·03	2·96	3·16	5·581	49,383	IV.
	V.	8·26	2·67	·439	10·45	73·09	29·01	3·77	33·97	1·04	3·24	3·74	8·06	35·96	11·99	7·501	5·44	7·256	7·22	1·44	3·13	5·71	10·83	21·57	3·69	2·30	5·620	63,346	V.
	VI.	9·05	·87	1·09	4·14	100·0	21·51	3·51	18·23	·750	4·04	2·909	6·22	18·69	8·00	6·12	4·16	5·28	3·69	·56	·44	3·33	9·19	19·95	2·43	·043	4·657	30,647	VI.
	VII.	12·90	1·80	·198	14·89	100·0	32·97	1·74	24·94	·433	·961	4·39	7·14	25·26	7·29	5·36	4·69	7·18	6·09	1·03	·67	..	12·5	25·92	2·61	·56	5·065	6,075	VII.
	VIII.	10·98	·43	·284	6·74	66·6	26·72	4·52	21·93	·552	6·17	3·49	5·28	24·12	16·92	10·63	4·24	8·27	2·79	1·18	1·68	5·00	..	17·04	3·22	4·48	5·646	14,733	VIII.
	IX.	15·41	4·05	1·56	8·69	100·0	18·90	4·35	17·08	2·15	6·76	4·35	7·84	24·60	11·28	8·96	5·36	7·27	3·45	..	..	..	..	9·09	2·02	5·88	7·04	4,334	IX.
	X.	15·69	·78	..	6·06	..	27·70	..	14·81	..	6·89	2·19	5·46	36·90	13·73	9·82	3·64	8·46	6·35	6·71	..	..	33·3	21·50	5·34	5·08	7·206	9,403	X.
	XI.	9·54	·498	..	3·39	100·0	20·06	1·86	31·49	·787	1·81	5·24	3·66	21·45	8·96	6·81	3·41	6·40	2·72	·505	·436	..	3·23	15·04	2·93	1·93	4·71	22,273	XI.
	XII.	6·25	·51	..	..	50·0	11·29	1·98	15·00	·42	2·29	1·99	4·94	22·09	9·89	7·70	7·30	4·32	3·92	·88	..	7·69	22·22	25·46	4·31	3·37	5·699	14,693	XII.
	XIII.	8·27	·47	·54	4·18	75·01	4·51	9·68	21·44	2·182	7·24	4·183	7·23	23·40	13·37	6·44	5·08	7·15	12·13	1·49	1·46	..	5·71	24·30	3·42	7·33	5·998	86,276	XIII.
																											Total Death Rate.	1916.	
Average Death Rate for ten years per 1,000 population according to districts	I.	·129	·199	·041	·059	·034	·939	·091	·929	·081	·041	·804	1·346	1·493	·327	1·133	1·815	·944	·364	·080	·029	·139	·711	·638	·699	·014	12·960	178,573	I.
	II.	·134	·204	·036	·014	·024	·311	·007	·508	·046	·014	·603	·746	1·009	·144	·851	1·098	·379	·120	·052	·015	·162	·598	·462	·796	·014	8·392	80,279	II.
	III.	·099	·153	·030	·039	·025	·358	·011	·538	·059	·019	·446	·768	·942	·146	·779	1·189	·407	·138	·032	·015	·141	1·157	·383	·787	·008	8·126	81,785	III.
	IV.	·121	·147	·018	·034	·043	·650	·027	·588	·063	·046	·506	·864	1·184	·186	·994	1·531	·636	·094	·072	·016	·176	·734	·592	1·039	·025	10·420	53,236	IV.
	V.	·251	·145	·032	·033	·053	·763	·050	·727	·050	·074	·593	·829	1·170	·251	·936	1·367	·744	·177	·096	·035	·150	·604	·549	1·245	·035	11·140	63,034	V.
	VI.	·227	·133	·112	·106	·031	·711	·090	·519	·035	·084	·794	·699	1·198	·223	·796	1·265	·548	·155	·064	·021	·182	·650	·441	1·682	·075	11·898	36,030	VI.
	VII.	·132	·186	·064	1·168	·071	·792	·099	·605	·034	·116	4·887	2·354	1·170	·166	·901	1·215	·605	·148	·117	·049	·068	·483	·897	2·496	·212	19·082	5,379	VII.
	VIII.	·759	·029	·012	·090	·012	·682	·075	·314	·053	·205	·819	·902	1·134	·229	1·013	1·092	·472	·101	·057	·019	·084	·676	·613	2·229	·115	11·889	16,149	VIII.
	IX.	1·290	·202	·116	·063	·042	·526	·148	·280	·052	·574	·400	·809	1·116	·270	1·056	1·286	·508	·106	..	..	·084	·472	·329	2·404	·130	12·228	5,322	IX.
	X.	·497	·263	·071	·147	·011	·405	..	·201	·051	·181	·594	·768	1·264	·137	1·031	1·286	·234	·062	·064	..	·178	·733	·619	1·906	·031	10·756	9,887	X.
	XI.	·377	·184	·036	·061	·012	·470	·031	·588	·034	·094	·585	·727	·978	·216	·810	1·054	·476	·145	·067	·004	·100	·566	·559	1·326	·062	9·578	22,456	XI.
	XII.	·179	·084	·062	·041	·025	·636	·037	·451	·015	·136	·411	·707	1·145	·185	·776	1·008	·393	·104	·061	..	·085	·982	·441	1·200	·118	8·866	16,860	XII.
	XIII.	·172	·179	·025	·040	·019	·454	·028	·518	·028	·030	·479	·713	1·162	·160	·820	1·170	·578	·108	·058	·015	·134	·624	·309	·669	·013	8·511	104,930	XIII.

TABLE 2.

Birth Rate according to Districts per 1,000 Population.

District.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	Tot[illegible] for Queensland.
1907 ..	23·36	32·24	28·18	28·47	26·42	29·79	21·89	20·11	15·50	23·56	21·76	28·66	31·20	26·80
1908 ..	23·60	32·87	28·90	28·74	27·32	31·39	23·03	20·84	12·64	25·61	21·17	23·48	28·46	26·78
1909 ..	24·03	32·24	28·31	27·77	27·42	31·05	20·33	19·54	12·51	25·88	22·31	27·37	31·15	27·29
1910 ..	24·65	31·58	29·20	29·22	26·71	29·09	21·21	20·58	11·52	24·05	21·91	27·66	38·91	27·34
1911 ..	25·39	31·24	29·07	30·96	25·90	29·56	20·08	19·97	18·69	25·96	23·89	27·70	31·44	27·03
1912 ..	28·94	32·37	32·19	29·47	30·21	28·69	19·84	19·51	19·75	23·91	25·68	27·97	31·98	29·70
1913 ..	30·46	33·94	33·57	32·37	30·59	27·99	21·71	23·13	13·28	27·26	26·37	26·61	30·23	30·26
1914 ..	30·47	31·46	32·13	30·69	29·57	27·77	21·93	20·76	19·66	25·61	25·37	28·67	29·07	25·66
1915 ..	32·26	30·75	29·43	30·84	31·29	26·04	20·63	20·42	18·92	26·09	26·48	25·70	27·26	30·04
1916 ..	30·68	30·24	29·77	27·75	29·03	27·87	25·66	19·88	19·16	24·17	23·86	21·06	24·69	28·61
Total for 10 years ..	273·84	318·93	300·75	296·28	284·46	289·24	215·31	204·74	171·64	252·10	238·80	264·88	306·39	279·51
Average ..	27·38	31·89	30·08	29·63	28·45	28·92	21·53	20·47	17·16	25·21	23·88	26·79	30·64	27·95

TABLE 3.

Infantile Mortality according to Districts.

District.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	Total for Queensland.
1909 ..	98·14	49·69	57·86	77·87	83·03	79·16	89·43	76·37	62·50	117·4	50·30	76·30	62·36	71·94
1910 ..	80·76	58·39	49·94	73·77	48·76	47·23	78·06	85·31	21·27	99·54	52·30	46·39	43·58	63·10
1911 ..	80·15	50·75	55·33	77·84	61·41	61·81	49·17	32·04	83·35	61·48	82·71	44·25	61·95	65·85
1912 ..	81·28	62·36	57·99	81·17	62·22	52·98	67·23	91·54	55·56	126·7	70·94	105·6	69·82	71·44
1913 ..	79·56	52·10	45·55	63·05	48·55	66·31	45·51	69·24	71·44	123·6	52·64	68·73	63·81	63·23
1914 ..	69·26	54·11	50·89	66·80	64·45	66·29	61·99	80·61	100·0	97·27	79·80	67·50	62·33	63·87
1915 ..	69·79	44·16	54·76	82·58	57·80	58·57	67·79	76·07	140·0	124·6	86·32	59·64	58·68	63·96
1916 ..	82·47	60·96	54·63	76·50	63·39	53·47	70·31	137·1	107·8	79·50	57·84	67·61	68·73	70·39
Total for 8 years ..	641·41	432·52	426·95	599·58	489·61	485·82	529·49	648·28	641·92	830·09	532·85	536·02	491·26	533·78
Average ..	80·18	54·57	53·37	74·95	61·20	60·73	66·19	81·04	80·24	103·76	66·61	67·00	61·41	66·72

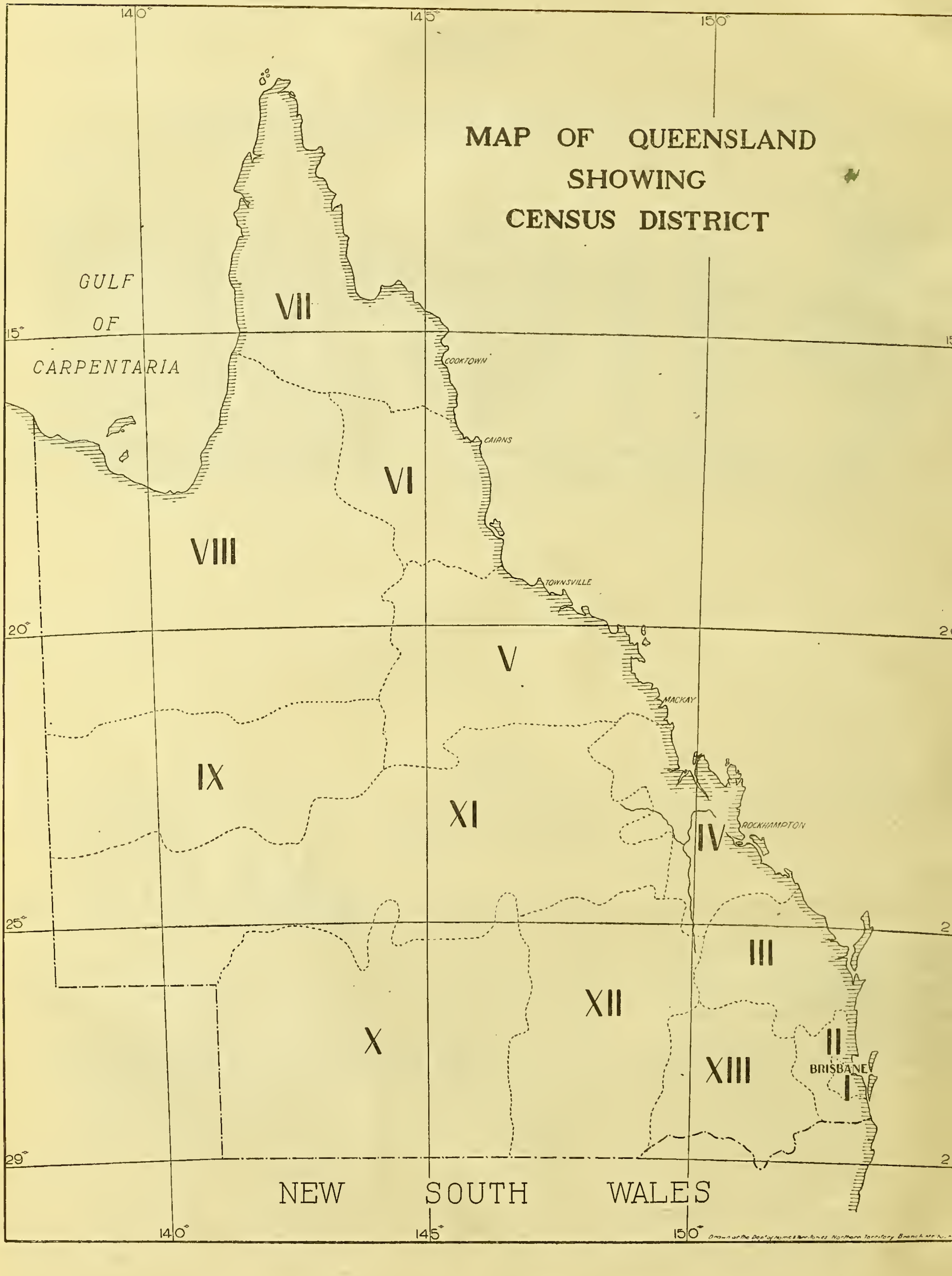
TABLE 4.

QUEENSLAND 1907 TO 1918 MEAN POPULATION OF VITAL STATISTICS DIVISIONS.

Division.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.
I. Metropolitan ..	144,416	147,155	151,334	156,911	162,773	167,157	172,523	178,247	181,218	178,573
II. Moreton	61,885	63,400	65,552	68,333	71,265	73,575	76,342	79,293	81,041	80,279
III. Wide Bay ..	67,262	68,412	70,225	72,678	75,253	77,136	79,463	81,945	83,154	81,785
IV. Port Curtis ..	44,416	45,105	46,229	47,769	49,383	50,537	51,979	53,515	54,216	53,236
V. Edgecombe ..	60,342	60,436	61,068	62,193	63,346	63,848	64,652	65,507	63,034	61,335
VI. Rockingham ..	25,648	26,527	27,683	29,124	30,647	31,922	33,411	35,000	36,073	36,030
VII. York Peninsula ..	6,213	6,122	6,080	6,080	6,075	5,999	5,943	5,884	5,721	5,379
VIII. Carpentaria ..	13,080	13,326	13,702	14,205	14,733	15,127	15,610	16,125	16,391	16,149
IX. Central Western ..	3,481	3,639	3,838	4,078	4,334	4,556	4,812	5,085	5,285	5,322
X. South Western ..	8,617	8,711	8,886	9,139	9,403	9,576	9,801	10,040	10,120	9,887
XI. Central	21,029	21,105	21,373	21,816	22,273	22,504	22,845	23,208	23,192	22,456
XII. Maranoa	12,561	12,920	13,411	14,034	14,693	15,227	15,858	16,532	16,959	16,860
XIII. Downs	69,959	72,959	76,754	81,374	86,276	90,516	95,403	100,621	104,389	104,930
Shipping	3,821	3,802	3,815	3,857	3,898	3,897	3,813	3,930	3,880	3,710
Total ..	542,730	553,619	569,950	591,691	614,352	631,577	652,555	674,932	686,924	677,630

TABLE 5.

—	No.	Arneth Classification per cent.					Arneth Index.	Polymorpho-Nuclear Neutroph.	Transitional.	Differential Count.			
		I.	II.	III.	IV.	V.				Large Mononuclear.	Lymphocytes.	Eosinophiles.	Mast cells.
Northern Territory Aboriginal Children (Breinl and Priestly)	39	25·8	45·8	23·3	4·8	0·3	71·6	52·3	2·0	1·2	33·9	10·5	0·1
North Queensland School Children (Breinl and Priestly)	150	32·5	42·0	20·6	4·5	0·4	74·5	56·1	4·2	2·4	29·5	7·7	0·04
New Guinea Native Children (Breinl and Priestly)	50	42·96	40·9	13·8	2·13	0·21	83·86	40·96	2·47	1·36	42·86	13·24	..
Hookworm-infected North Queensland Children	78	42·26	40·59	14·39	2·63	0·13	82·85	54·03	2·98	0·57	30·85	11·01	0·56



MAP OF QUEENSLAND SHOWING CENSUS DISTRICT

Drawn at the Dep't of Home & Territories Northern Territory Branch

Chart I.

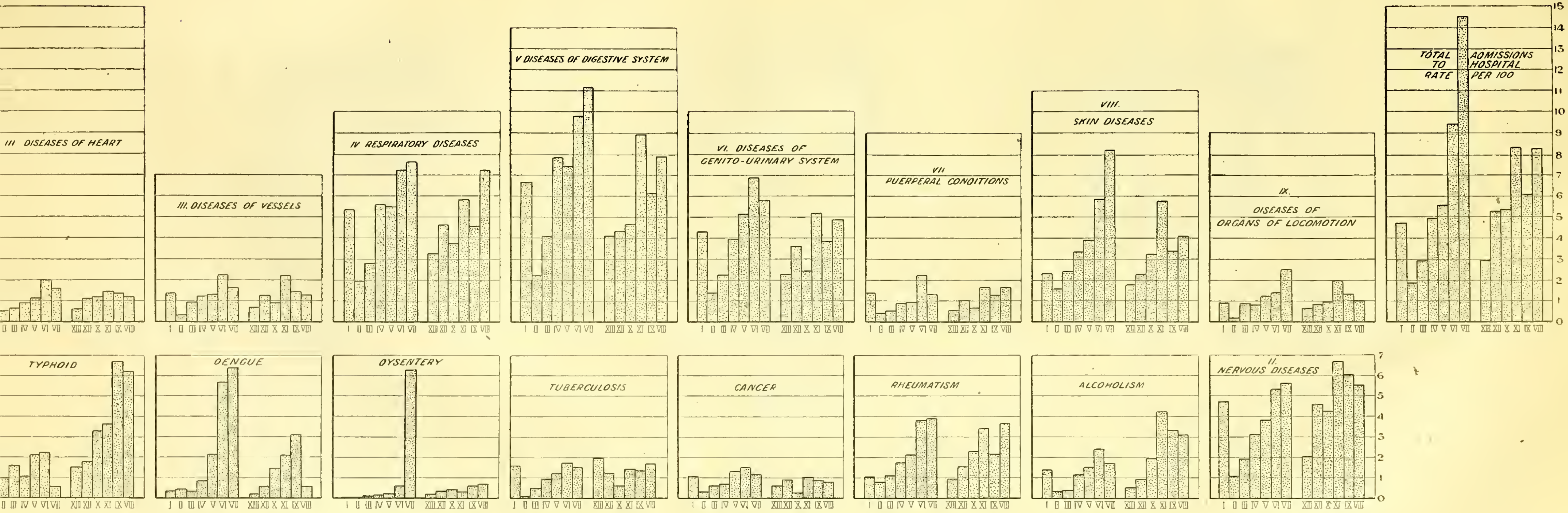

III DISEASES OF HEART
III. DISEASES OF VESSELS
IV RESPIRATORY DISEASES
V DISEASES OF DIGESTIVE SYSTEM
VI. DISEASES OF GENITO-URINARY SYSTEM
VII PUERPERAL CONDITIONS
VIII. SKIN DISEASES
IX. DISEASES OF ORGANS OF LOCOMOTION
TOTAL ADMISSIONS TO HOSPITAL RATE PER 100
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TYPHOID
DENGUE
DYSENTERY
TUBERCULOSIS
CANCER
RHEUMATISM
ALCOHOLISM
II. NERVOUS DISEASES
7
6
5
4
3
2
1
0
I II III IV V VI VII
XIII XII X XI IX VIII

Chart II.

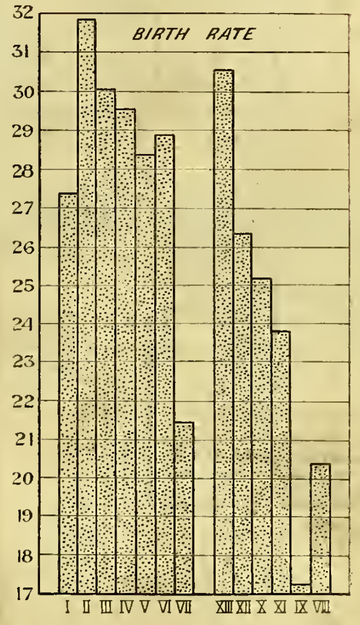


Chart III.

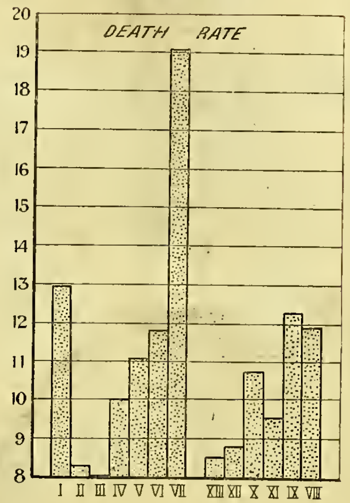
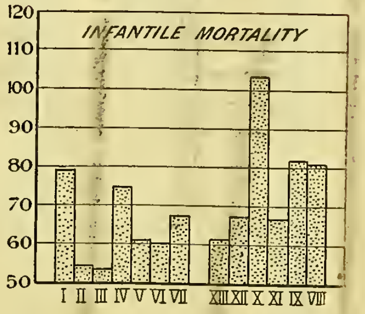


Chart IV.



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